

Muelleria

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MUELLERIA

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Vol. 3

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No. 4

THE SPECIES OF *PARONYCHIA* (CARYOPHYLLACEAE) IN VICTORIA

by

HELEN I. ASTON*

SUMMARY

Two species of *Paronychia*, *P. brasiliana* DC. and *P. franciscana* Eastwood, are naturalized in Victoria. Previous records of *P. chilensis* DC. are erroneous, and are due to misidentification of *P. franciscana*.†

METHOD

Except for one 1969 collection of *P. brasiliana* DC. from Genoa, East Gippsland, Willis (1973) referred all Victorian material of *Paronychia* to *P. chilensis* DC. Black (1963) also referred Victorian collections to *P. chilensis* but Eichler (1965) altered this determination to *P. brasiliana*.

To resolve the identity of the Victorian plants all Australian collections of *Paronychia* held by the National Herbarium of Victoria were examined. Two species were distinguished and, with the use of the revision by Chaudhri (1968), determined as *P. brasiliana* DC. and *P. franciscana* Eastwood. Portions of nine representative collections were submitted to Dr. M. N. Chaudri, University of Islamabad, Islamabad, Pakistan, who kindly confirmed the identifications.

DISTRIBUTION

Paronychia brasiliana DC.

The earliest Victorian collections held at Melbourne each bear a machine-printed, blue "Botanical Museum of Melbourne./Ferd. Mueller, Ph. & M.D." label annotated in unidentified handwriting with the locality of Melbourne Botanic Garden, but without collector or date. The collections were probably made before Mueller's death in 1896 and were possibly taken

* National Herbarium of Victoria.

† Only one other species of *Paronychia* has been recorded from Australia. This is *P. argentea* Lam., which Black (1963) reported for South Australia from "Palmer (Murray lands west of river)". J. P. Jessop (pers. comm., Nov. 1976) could not locate any voucher collection for this report at the State Herbarium, Botanic Garden, Adelaide, and therefore Black's identification remains unverified.

from cultivated material. The only Victorian collections of undoubtedly naturalized populations are from East Gippsland (Genoa, 1969; Maramingo Hill, 1970; Buchan-Bruthen road, 1971; Mallacoota, 1972) and from the Melbourne suburb of South Yarra (1977). Several collections from eastern New South Wales are also held at Melbourne.

SPECIMENS EXAMINED:

(C) indicates verified by Dr. Chaudhri. Victoria—(C) Melbourne Botanic Garden, anon., ? pre-1896 (MEL 503801; MEL 503803); Shrine of Remembrance, South Yarra, Melbourne, in lawn, *H. I. Aston* 1998, 3.iii.1977 (AD, CANB; MEL 515990; NSW); Maramingo Hill, East Gippsland, A.C. *Beaglehole* 33629, 9.viii.1970 (MEL 516547); Buchan-Bruthen road, at junction of Dead Horse Creek Road, East Gippsland, A. C. *Beaglehole* 37551, 23.iii.1971 (MEL 516548); Shrine of Remembrance, South Yarra, Melbourne, in lawn, M. G. *Corrick* 5836 and 5837, 2.iii.1977 (MEL 515989; MEL 515991); (C) Genoa, grounds of Forests Commission's office, J. H. *Willis* and A. C. *Beaglehole*, 11.xi.1969 (MEL 504925); Mallacoota, camping and picnic reserve on north slopes of township, J. H. *Willis*, 19.xii.1972 (MEL 504924). New South Wales—(C) Sydney, W. V. *Blewett*, 27.iii.1931 (MEL 504923); Paterson, H. A. *Fry*, 28.iv.1933 (MEL 504926 (=NSW 51881)); Guyra, a common prostrate weed which has become widespread at Guyra, E. N. *McKie* 2450, summer 1945-46 (MEL 504928 (=NSW 51882)); Between Cambewarra Mountain and Beaumont, west of Nowra, J. H. *Willis*, 22.iii.1954 (MEL 504927).

This species is native to southern Brazil, Uruguay, and north-east Argentina and is introduced in South Africa and Australia. In Australia there are verified records from Victoria, New South Wales, the Australian Capital Territory, and south-east Queensland. (Beadle, 1972; Beadle, Evans and Carolin, 1972; Burbidge and Gray, 1970; Chaudhri, 1968).

***Paronychia franciscana* Eastwood**

The earliest collection held at Melbourne warrants exactly the same comment as that given for the earliest collections of *P. brasiliensis*. Apart from this early collection of possibly cultivated material there are collections of undoubtedly naturalized populations from within the Melbourne suburban area (1909, 1946, 1961, 1965) and from the following widespread country locations in Victoria—Werribee River (1917) and Diggers Rest (1917), approximately 30 km south west to north west of Melbourne; Bairnsdale district (between 1917 and 1930); Eldorado (pre-1919) and Londrigan (1936), 20 km and 10 km respectively east of Wangaratta; Bendigo (1949); Rokewood/Shelford (1962), approximately 40 km south of Ballarat. There are no collections from other Australian States held at the National Herbarium of Victoria.

SPECIMENS EXAMINED:

(C) indicates verified by Dr. Chaudhri. Victoria—Melbourne Botanic Garden, anon., ? pre-1896 (MEL 503802); (C) Londrigan, R. A. *Black*, 16.xi.1936 (MEL 504934); (C) Werribee River, growing on banks, C. *French jr.*, 15.i.1917 (MEL 504936); (C) Near Diggers Rest, common along road, C. *French jr.*, 20.v.1917 (MEL 504930); Bairnsdale district, T. S. *Hart*, between 1917 and 1930 (MEL 504935); (C) Queens Park, Moonee Ponds, fairly plentiful, J. P. *McLennan*, 1909 (MEL 504931); Diamond Hill, Ben-

digo, F. Robbins, 29.x.1949 (MEL 516546); Shrine of Remembrance, Melbourne, lawns, R. V. Smith, ii.1946 (MEL); Shrine of Remembrance, lawns, R. V. Smith, 9.i.1961 (MEL); Eldorado, per H. B. Williamson, pre-1919 (MEL 504929); (C) At bridge on Warrambine Creek, between Rokewood and Shelford, J. H. Willis, 18.xi.1962 (MEL 504932); (C) South Yarra, J. H. Willis, 14.xii.1965 (MEL 504933).

P. franciscana is native to Chile and introduced in the vicinity of San Francisco, U.S.A., and in Australia (Victoria).

TAXONOMY

Chaudhri (1968) recognises 109 species of *Paronychia* Miller (1754). He places the three species considered here in the subgenus *Paronychia* (57 spp.), section *Paronychia* (56 spp.) and subsection *Paronychia* (39 spp.). Within this subsection Chaudhri maintains *P. brasiliiana* DC. (1804) and *P. franciscana* Eastwood (1901) as distinct but similar species in the series *Planitoriae* (2 spp.) and places *P. chilensis* DC. (1828) in the series *Paronychia* (29 spp.). All three species are thus closely-related, and confusion between them is understandable.

P. brasiliiana and *P. franciscana* share the following characters: —

Plant perennial, herbaceous, with a slender woody tap root 1.0–2.0 (–4.0) mm diameter. Stems to c. 30–35 cm long, to 1.5 mm diameter, much-branched, prostrate with ascending extremities, many-noded, the internodes <2.0 cm long and often only 2–few mm, glabrous to pubescent; basal parts somewhat woody with the leaves fallen showing knotted nodes bearing persistent stipule-bases. *Leaves* 4–10 mm long, sessile, opposite or appearing whorled or fascicled, narrow-elliptic to \pm oblanceolate, tapered to the base, acute, distinctly mucronate, moderately densely covered with forwardly-directed, simple hairs; mucro very slender, translucent, 0.3–0.9 (–1.0) mm long; leaf pair joined at the base on either side of the stem by a conspicuous, broad-lanceolate, acuminate, silvery-white, scarious stipule which splits longitudinally as growth proceeds, producing two half-stipules at the base of each leaf of the pair; leaves when fascicled each with two unsplit stipules at the base; *stipules* 2.5–6.5 mm long, with fine hairs along the margins. *Flowers* several together in pseudo-axillary clusters together with silvery, stipule-like bracts; clusters many along each stem, shorter than the subtending leaves. *Flower* near-sessile, with a cup-shaped receptacle (perigynous zone) 0.25–0.35 (–4) mm long, this receptacle much shorter than the sepals. *Sepals* 5, c. 1.0–1.4 (–1.65) mm long (excluding awn), erect to slightly spreading, continuous with the summit of the receptacle, oblong, with a broad, thickened median band and a membranous margin, strongly concave with a distinct apical hood and a prominent, stiff, slender awn arising from the back of the hood. *Petals* absent or rarely appearing as a minute translucent projection c. 0.1 mm long arising from the summit of the receptacle at the junction of two sepals. *Stamens* 5, opposite to and attached

at the base of the sepals, much shorter than the sepals; *filaments* filiform, c. 4.0 mm long; *anthers* c. 1.5 mm long, oblong, bilocular, dorsifixed, opening introrsely by longitudinal slits. Ovary superior, ovoid, inilocular with one ovule, minutely papillose particularly over the apical region; *style* very short and squat (almost absent) with two (rarely three) short, divergent, sometimes almost horizontal, stigmatic arms; *ovule* basal, amphitropous. *Fruit* an obovoid to subglobose utricle, c. 1.0–1.25 mm long x 0.85–1.1 mm broad, enclosed in the persistent calyx; pericarp membranous and rupturing at the base. *Seed* subglobose, smooth, dark.

The following key gives the distinctions between *P. brasiliiana* and *P. franciscana* as shown by the Australian collections examined. These distinctions agree in essentials with those given by Chaudhri (l.c.).

Flower clusters \pm exposed, the leaves and stipules of each node usually shorter than the succeeding internode and therefore not concealing the flower cluster at the node above. *Shoots* with the nodal leaves and flower clusters moderately spaced along the stem, the *internodes* clearly visible. *Flowers* glabrous, or with a few short hairs externally at the junction of two adjacent sepals with the receptacle. *Sepals* equal, glabrous, deeply-hooded, at maturity the median band usually turning dark reddish-brown and the margin white and scarious; *hood depth* (distance from apex of hood to insertion of awn) c. 0.3–0.4 (–0.5) mm, the scarious margin occupying c. one third to one half of this depth. *Awn* 0.5–0.85 (–1.0) (average 0.6) mm long, *spreading* at an angle of 10°–80° (mostly c. 40°) from the longitudinal axis of the sepal, mostly about half (40%–62%, average 55%) as long as the sepal length (sepal base to point of attachment of the awn) *P. brasiliiana*

Flower clusters mostly concealed by leaves and stipules, each internode usually shorter than the leaves and stipules of the node below. *Shoots* usually densely covered with overlapping leaves and stipules, the *internodes* hidden. *Flowers* with short hairs externally at the junction of two adjacent sepals with the receptacle, and also usually hairy on the receptacle and the sepal hood, also often sparsely hairy over the whole sepal. *Sepals* somewhat unequal, 3 with very narrow margins and glabrous to slightly hairy, 2 with broad white scarious margins and usually strongly hairy, particularly on the hood, including the hood margin; all 5 sepals at maturity with the median band usually light straw-brown; *hood depth* c. 0.2–0.3 mm. *Awn* 0.4–0.6 (–0.7) (average 0.5) mm long, *erect* to spreading at an angle of 0°–40° (mostly c. 10°), usually about one third (27%–45%, average 37%) as long as the sepal length *P. franciscana*

In brief, *P. franciscana* differs from *P. brasiliana* in the (usually) more densely-clothed shoots giving a more compact, mat-forming habit, the flowers pubescent rather than glabrous, the somewhat unequal, paler, less deeply-hooded sepals, and the shorter, erect or near-erect awns.

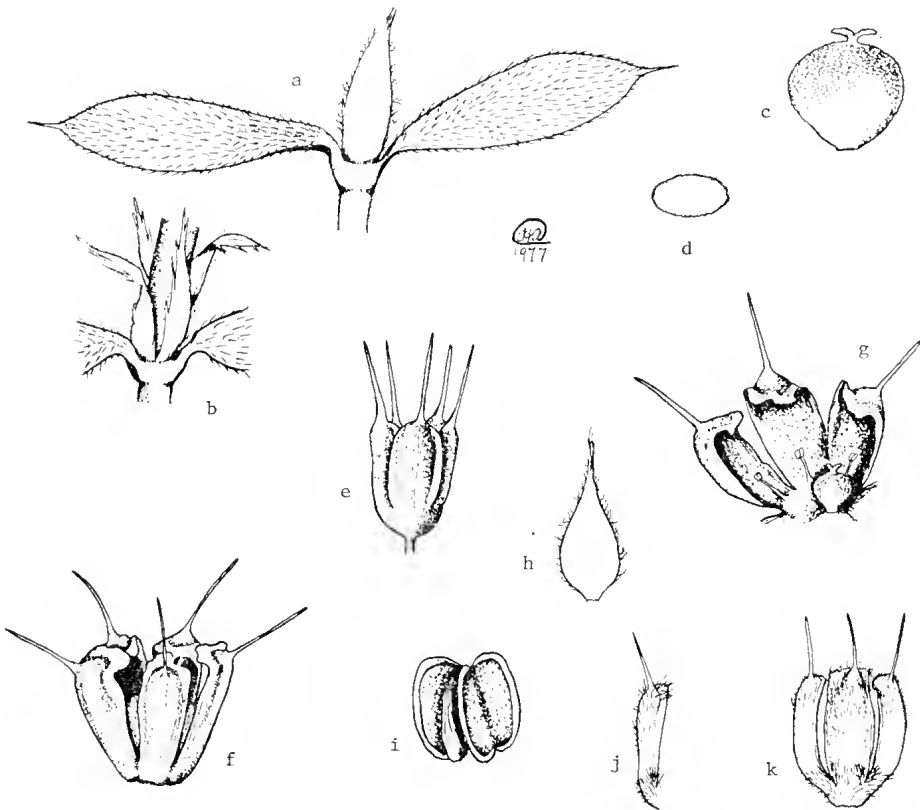


Fig. 1.—a–i, *Paronychia brasiliana* (from Aston 1998): a—leaf pair connected by stipule at base, x 6; b—base of leaf pair showing the stipule split lengthwise to produce two half-stipules per leaf, x 6; c—papillate ovary with style and stigmas, lateral view, x 14; d—ovary, T.S., x 4; e—flower bud, the awns still erect, x 11; f—mature flower, external view, showing the very small receptacle and the 5 glabrous sepals each with a thickened median band, membranous margin, deep hood, and slender, spreading awn, x 11; g—portion of mature flower from within, showing 3 sepals, gynoeceium, short receptacle, and stamens, x 11; h—stipule, x 10; i—anther after dehiscence, x 12. j–k, *Paronychia franciscana* (from Williamson, MEL 504929): j—one of the two broad-margined sepals, lateral view, x 11; k—portion of mature flower showing one broad-margined, strongly-hairy sepal and two narrow-margined, less hairy sepals. Note shallow hoods and short, erect awns, x 11.

Chaudhri (l.c.) also mentions very slight differences in internode pubescence and in styles, but these differences seem unstable. He gives larger stipules and very knotty shoots as further distinguishing characters for *P. franciscana*, but these

characters are not wholly reliable on the Australian material examined. However there is a tendency for larger stipules, shorter internode length, and a higher ratio of node diameter to internode diameter in some collections of *P. franciscana*. Coupling of the shorter internode and higher node/internode diameter ratio is more frequent in *P. franciscana*, and, where it occurs gives a more knotted appearance to the stem. This is most conspicuous over the lower stem portions from which leaves and stipules have fallen. Minimum, maximum and average measurements from the specimens seen are summarised as:—

P. brasiliensis—stipule length 2.5–6.5 mm (average 4.4); internode length 1.5–19.0 mm (average 9.8); ratio node: internode diameter 1.8:1 – 2.5:1 (average 2.2:1).

P. franciscana—stipule length 4.0–6.0 mm (average 4.9); internode length 2.0–12.0 mm (average 5.0); ratio node: internode diameter 1.6:1 – 4.0:1 (average 2.3:1).

Until now, *P. franciscana* has been identified in Victoria incorrectly as *P. chilensis*, but this latter species is distinguished from both *P. franciscana* and *P. brasiliensis* by the following characters:—

Receptacle well-developed, 0.8–1.0 mm long, only a little shorter than the sepal which is (excluding awn) 1.0–1.3 mm long; *petals present*, 0.25–0.3 mm long, subulate-filiform and indistinct; *awn short*, 0.25–0.3 mm. The first of these characters, the well-developed receptacle, is also the key distinction (Chaudhri, l.c.) of the series *Paronychia* from the series *Planitoria* (see opening paragraph under “taxonomy”).

ACKNOWLEDGEMENT

Dr. M. N. Chaudhri's assistance with identification is gratefully acknowledged.

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 Eichler, H. J. (1965)—Supplement to J. M. Black's Flora of South Australia (second edition, 1943–1957). (Government Printer: Adelaide).
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THE HERBACEOUS SPECIES OF ECHIMUM (BORAGINACEAE) NATURALIZED IN AUSTRALIA

by

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SUMMARY

This field and herbarium study shows that there are three distinct herbaceous species of *Echium*, *E. italicum* L., *E. plantagineum* L. and *E. vulgare* L., naturalized in Australia. A key to these species, a description and distribution map for each, and lists of specimens in Australian herbaria are provided. An account of their overseas distribution, the history of their introduction and spread in Australia, and a discussion of previous nomenclatural confusion are also given.

INTRODUCTION

The genus *Echium* can be divided into two distinct evolutionary groups: the predominantly woody species of the Macaronesian Archipelago (about 25 species), and the herbaceous species which are native around the Mediterranean Sea and in the British Isles (about 25 species). The herbaceous species have been introduced and become quite widespread in southern Africa, the Americas, New Zealand and Australia.

In the past, the taxonomy and nomenclature of the genus have been confused in Australian and overseas literature. Following recent reviews of the European species by Gibbs (1971, 1972) an attempt is made here to clarify the nomenclature, taxonomy, history and distribution of the herbaceous *Echium* species naturalized in Australia.

MATERIALS

Field collections of *Echium* plants were made between 1969 and 1976 and specimens have been lodged at the Keith Turnbull Research Institute, Frankston, Victoria (KTRI), the National Herbarium, Sydney (NSW), the National Herbarium, Melbourne (MEL), the Melbourne University Herbarium (MELU), and the Royal Botanic Gardens, Kew, England (K). Other *Echium* specimens at the above Australian herbaria, and specimens at the Western Australian Herbarium, Perth (PERTH); the Northern Territory Herbarium, Alice Springs (NT); the State Herbarium of South Australia (AD) and the Waite Institute Herbarium (ADW), Adelaide; the Queensland Herbarium, Brisbane (BRI); Herbarium Australiense (CANB) and the Botanic

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Gardens Herbarium (CBG), Canberra; and the Tasmanian Herbarium, Hobart (HO), were also examined.

All identifications were made by the author. Identities of representative specimens (those marked MEL *) were later confirmed by Dr. P. E. Gibbs, Department of Botany, The University, St. Andrews, Scotland.

KEY TO THE HERBACEOUS SPECIES NATURALIZED IN AUSTRALIA

1. Indumentum of coarse, stiff, crowded yellowish-white hairs; corolla yellowish-white, five stamens long-exserted *E. italicum*
1. Indumentum of softer, less-crowded white hairs; corolla blue, reddish, or purple, rarely white, stamens not all long-exserted 2
2. Indumentum of soft white hairs and sometimes, especially on the stems and leaf margins, a sparse underlayer of softer hairs; basal leaves broadly ovate, petiolate, with prominent lateral veins; two stamens long-exserted, one short-enclosed, and two intermediate-enclosed; corolla glabrous except for sparse hairs along veins and margins *E. plantagineum*
2. Indumentum of sparse, stiff, tubercule-based white hairs and a dense underlayer of softer white hairs; basal leaves narrowly lanceolate, sessile, without prominent lateral veins; four stamens long-exserted, one short-enclosed; corolla pubescent, especially along veins and margins *E. vulgare*

DESCRIPTIONS

***E. italicum* L., Sp. Pl. 139 (1753)**

Synonym: *E. altissimum* Jacq., Fl. Austriacae 5: 35 (1778)

Common name: Italian Bugloss.

Erect, very hispid biennial or perennial, 40–100 cm tall, usually with a single, unbranched, spike-like flowering stem, but sometimes much branched; *indumentum* of coarse, stiff, crowded, yellowish-white setae (1–3 mm) and sometimes, especially on the stems and leaf margins, an underlayer of softer yellowish-white hairs. Basal leaves 200–350 x 15–40 mm, lanceolate, the lateral veins quite apparent on lower surface; cauline leaves more or less narrowly elliptic. Calyx 6–7 mm; corolla 10–12 mm, very narrowly infundibuliform, yellowish-white, hairy—prominently so on veins and margins; 5 stamens long-exserted; filaments white-translucent; pollen yellowish; style hairy. Nutlets 2.5 x 3.5 mm, triquetrous, irregularly tuberculate, whitish-grey.

SPECIMENS EXAMINED:

South Australia—Waterfalls, 10 km south of Mannum, H. Amtsberg,

11.xii.1966 (AD 96718036); Cudlee Creek, near Kersbrook, *per* H. W. Andrew, 6.xii.1916 (AD 97621109); near Clare, *per* F.S. Bailey, iii.1928 (AD 9762110); Naracoorte, Bennet, 22.iv.1943 (ADW 4918); Mt. Pleasant, J. M. Black, iv.1912 (AD 97621107); Palmer, J. W. Chigwidden, 17.vi.1970 (ADW 44325); Waterfall near Mannum, J. B. Cleland, 3.iv.1924 (AD 966050997); near Kanmantoo, J. B. Cleland, 6.ii.1937 (AD 966050965); Rosebank, near Mt. Pleasant, J. B. Cleland, 30.x.1937 (AD 966050949); road to Cambrai beyond Melrose's, near Mt. Pleasant, J. B. Cleland, 25.vi.1940 (AD966050981); about 20 miles south of Meningie, B. Copley 1833, 17.i.1968 (AD 96806088); Melrose, J. G. Davies, 9.xii.1933 (ADW 1843); near Palmer towards Mannum, J. G. Davies, 2.vi.1934 (ADW 1843); between Palmer and Tungkillo, *per* A. G. Edquist, xi.1917 (AD 97621108); Caloote and Palmer Hill, H. H. D. Griffith, xii.1909 (AD 97621107); Hardwicke Bay, Yorke Peninsula, D. Keane, ix.1968 (AD 96932719); between Nairne and Kanmantoo, D. E. Symon, 31.x.1953 (ADW 9894); between Brentwood and Warooka, Yorke Peninsula, D. E. Symon 1952, 1.iii.1962 (ADW 24714).

New South Wales—Shire of Coreen, near Corowa, E. Bray, 1914 (NSW 137351); Young, K. V. Byrne, xii.1950 (NSW 137347); Corowa, A. Campbell, xii.1924 (NSW 137350); Riverina Highway, Corowa, Milvaine, 2.xii.1975 (KTRI; NSW 137349); 4 miles from Corowa towards Albury, C. W. E. Moore M215, 19.ii.1946 (CANB 54587); 6 miles east of Corowa, C. W. E. Moore M1131, 11.i.1949 (CANB 20489); Wagga side of Corowa, F. J. Nicholson, iv.1950 (NSW 137353); 8 km east of Corowa on the Albury Road, C. M. Piggitt & J. E. Simmonds, 12.vii.1976 (KTRI; MEL); Urana, *per* W. Seddon, ii.1933 (NSW 137348); Corowa, Shire Clerk, 3.iii.1947 (NSW 3104); Wooloona property, near Young, W. J. Smith, xi.1924 (NSW 137346); between Corowa and Howlong, G. A. Withers 36, 1952 (NSW 137352).

E. plantagineum L., Mant. Plant. Alt. 202 (1771)

Synonyms: *E. lycopsis* L., Fl. Anglica 12 (1754) *pro parte* (lectotype excl.).

E. maritimum Willd., Sp. Pl. 1 (2) : 788 (1798) *sens. str.*

Common names: Paterson's Curse, Salvation Jane, Purple Bugloss.

Erect, softly hairy annual or biennial, 20–60 (sometimes to 200) cm tall, with one to many flowering stems; *indumentum* of soft, appressed white setae (1–3 mm) and sometimes, especially on the stems and leaf margins, a sparse underlayer of softer white hairs. Basal leaves 50–200 x 15–100 mm, broadly ovate, petiolate, with prominent lateral veins on upper and lower surfaces; cauline leaves oblong to lanceolate, the uppermost more or less cordate at the base. Calyx 7–10 mm at anthesis, up to 15 mm in fruit; corolla 18–30 mm, broadly infundibuliform, blue becoming pink through purple, occasionally white, glabrous except for sparse hairs on the veins and margins; 2 *stamens* long-exserted, 2 intermediate-enclosed, and 1 short-enclosed; filaments reddish-blue with occasional long hairs; pollen bluish-grey; style hairy. Nutlets 2 x 2.5 mm, triquetrous, tuberculate, pale brownish-grey.

SPECIMENS EXAMINED:

Western Australia—Roleystone, T. E. H. Aplin 1249, 14.xi.1961 (PERTH); white-flowered form, Bushmead, *per* W. & S. Branch, 12.x.1965 (PERTH); Darlington, W. M. Carne, 11.x.1925 (PERTH); Geraldton, R. Chant, 21.xi.1973 (KTRI; MEL); Bullabulling, A. J. Cough 131, 18.ix.1963 (PERTH); between Albany and Swan River, J. Forrest, xi.1881 (MEL); Darlington, C. A. Gardner,

x.1925 (PERTH); Muresk, P. Garstone, date ? (PERTH); Upper Swan, D. Gilbey, 27.vii.1973 (KTRI; MEL* 502819, 502820; MEL); Denmark, D. A. Herbert, ii.1920 (PERTH); Darling Range, M. Koch, xi.1907 (NSW 137381); white-flowered form, Jerramungup, A. A. Marsh, 3.xi.1975 (PERTH); Toodyay, G. Meadly, 28.ix.1972 (PERTH); Margaret River, V. B. Morti, 12.x.1946 (PERTH); Broomehill, K. Newbey 1152, 16.x.1963 (PERTH); white-flowered form, Toodyay township, N. Ollerenshaw & N. Carriage NC046, 2.x.1975 (CBG 061494); Northam, J. Peirce, 7.x.1975 (PERTH, 2 sheets); flowers pink with white edges, Northam, J. Peirce, 7.x.1975 (PERTH); flowers pink with white edges, 2 miles from Northam on the York Road, J. Peirce, date ? (PERTH); Kalbarri turnoff on North West Coastal Highway, G. Perry 293, 25.ix.1974 (PERTH, 2 sheets); Bodallin township, G. Perry 538, 18.x.1975 (PERTH, 2 sheets); Broom Hill, P. Ripper, 21.xi.1973 (K; KTRI; MEL); Midland Junction, R. Roe 163, 27.x.1934 (CANB 7717); Beverley, R. D. Royce, x.1936 (PERTH); Midland, R. D. Royce 10320, 5.x.1972 (PERTH); Guildford, Rutherford, ix.1916 (PERTH); Northam, H. Salasoo 66, 26.ix.1949 (NSW); Jane Brook Stud Farm, Toodyay Road, F. Schoonens, 1.xi.1973 (KTRI; MEL*; MEL); Caversham School, F. Schoonens, 1.xi.1973 (KTRI; MEL*); white-flowered form, Caversham School, F. Schoonens, 1.xi.1973 (KTRI); Victoria Road, Caversham, F. Schoonens, 1.xi.1973 (K; KTRI; NSW 137380); Midland cemetery, F. Schoonens; 1.xi.1973 (K; KTRI; MEL); Midland dog pound, F. Schoonens, 1.xi.1973 (KTRI).

Northern Territory—Trucking yard, 2.9 miles north of Alice Springs, G. Chippendale, 11.x.1956 (CANB 74630; NSW; NT 3034); east side of Alice Springs, G. Chippendale, 10.x.1961 (AD 96325148; MEL; NT 8442); Banka Banka Station, T. R. Gorle, 26.viii.1964 (NT 11443); McDonnell Trucking Yards, A. S. Mitchell 212, 28.i.1975 (NT 44514); Victory Downs Homestead, F. C. Vasek 680918–16, ix.1968 (AD 97004219; NT 23533).

South Australia—white-flowered form, Gawler, A. J. Adams, 12.xii.1932 (AD 966080059); Big Swamp, C. R. Alcock 2635, 4.ii.1969 (AD 96930277; ADW 37327); Innes National Park, C. R. Alcock 4515, 6.x.1974 (ADW 46597); Innes National Park, C. R. Alcock 4691, 9.x.1974 (ADW 46598); Kapunda, C. D. Andrew, 12.xi.1916 (AD 9762112); Waite Institute, Anon., 3.ix.1930 (ADW 1844); white-flowered form, Waite Institute, Anon., 3.xi.1930 (ADW 1846); near Port Augusta, J. C. Anway 352, 7.ix.1965 (AD 96623025; MEL; NSW; PERTH); Waite Institute, J. W. Banfield, 24.ix. 1953 (ADW 13083); Sturt Highway, 24 miles west of Blanchetown, R. & R. Belcher, 22.x.1967 (MEL); Fullarton, J. M. Black, xi.1903 (AD 97621120); Piles Paddock, J. M. Black, 23.x.1904, 18.x.1905 (AD 97621120); Gladstone, J. M. Black, xii.1905, 19.ix.1906, 20.v.1907 (AD 97621120); Napperby, J. M. Black, 21.ix.1906 (AD 97621120); Adelaide Plains, J. M. Black, xi.1906 (NSW 137388); Nuriootpa, J. M. Black, 8.i.1912 (AD 97621125); Hammond, J. M. Black, 5.ix.1912 (AD 9762112); Gladstone, J. M. Black, xi.1913 (AD 97621121); white-flowered form, Hawker, J. M. Black, 10.x.1917 (AD 97621123); Gladstone, J. M. Black, 1.xi.1920 (AD 97621124); white-flowered form, Gladstone, J. M. Black, xii.1923 (AD 97621121); Glen Osmond, J. M. Black, 1.i.1924 (AD 97621126); Nortons Summit Road, J. M. Black, xi.1937 (AD 97621127); Hundred of Ramsay, B. J. Blaylock 1140, 24.xi.1968 (AD 97005168); between Glen Osmond and Crafers, E. S. Booth 37, 8.xi.1956 (AD 95812159); Mannum, R. Britton, 6.vi.1973 (K); Waikerie, R. Britton, 6.vi.1973 (K); Hill River, S. Brown, xii.1906 (NSW 137384); Orama Paddock, Koonamore, B. B. Carrodus 5230661, date ? (AD 966100188); Beaumont, J. B. Cleland, 21.i.1936 (AD 966050995); Mount Remarkable, J. B. Cleland, 8.xi.1936 (AD 966050966); Beaumont, J. B. Cleland, 15.xi.1938 (AD 966050963); Knoxville, J. B. Cleland, 28.x.1945 (AD 966021558, 966050979); white-flowered form, near Loxton, J. B. Cleland, 13.x.1960 (AD 966071279); near Adelaide, H. T. Clifford 114, i.1947 (NSW); Hundred of Wiltunga, B. Copley 35, 13.ii.1966 (AD 96617147); Bute, B. Copley 454, 6.viii.1966 (AD 96645138); Bute district, B. Copley 617, 15.ix.1966 (AD 96701055); white-flowered form, 1.5 km from Barunga Gap to Barunga Tennis Court Road, B. Copley 837, 31.x.1966 (AD 96703067); near Snowtown Railway Station, B. Copley 1226, 24.iii.1967 (AD 96833267); Watson, B. Copley 2702,

30.vii.1969 (AD 96937162); 6.5 km from Bute on Snowtown Road, B. Copley 2882, 30.x.1969 (AD 97035060); Koonamore Vegetation Reserve, M. Crisp 179, 25.v.1971 (MEL 97143220); Willunga Hill, J. Czorny 121, 10.xi.1966 (AD 96727300); Mitcham, W. Daw, viii.1946 (AD 966050338); Elbow Hill, J. A. Dickinson, 4.vii.1973 (K; KTRI); Warunda, J. A. Dickinson, 5.vii.1973 (K); Pt. Gibbon, J. A. Dickinson, 4.ix.1973 (K; KTRI); Little Swamp, near Pt. Lincoln, J. A. Dickinson, ix.1973 (MEL*); Wangary, J. A. Dickinson, 22.ii.1974 (K; KTRI); Warrow, J. A. Dickinson, 22.ii.1974 (K; KTRI; MEL); Big Swamp, near Pt. Lincoln, J. A. Dickinson, 22.ii.1974 (MEL*); Kellidie Bay, J. A. Dickinson, 22.ii.1974 (K; KTRI); near Redhill, N. N. Donner 559, 8.ix.1962 (AD 96314129); Petersburg, J. W. Durger ?, vi.1924 (NSW 137385); Waite Institute, C. M. Eardley, 29.ix.1937 (ADW 18358); fasciated form, Waite Institute, C. M. Eardley, 30.ix.1938 (ADW 18359); Quandong Station, 140 km east of Peterborough, T. Fatchen Q54, 25.xi.1970 (AD 97118172); white-flowered form, Waite Institute, R. M. Feuerheerdt, 19.xi.1952 (ADW 8102); Waite Institute, R. M. Feuerheerdt, 12.ix.1955 (ADW 13180); Hergott Springs, J. D. Fitzgerald, x.1920 (NSW 137382); white- and blue-flowered forms, locality unknown but also occur on hillsides above Waite, T. Gepp, 20.viii.1945 (ADW 5439); Waterfall Gully Road, J. W. Green 136, 30.vii.1950 (AD 966060028); Hundred of Joanna, D. Hunt 285, 22.x.1961 (AD 96150871); white-flowered form, Joanna district, 10 km south-east of Naracoorte, D. Hunt 722, 10.iii.1962 (AD 96219055); Moolooloo Station, Northern Flinders Range, E. H. Ising 441, x.1918 (AD 966071194); Barton, E. H. Ising 1378, 19.ix.1920 (AD 966071083; NSW); Mile End, E. H. Ising, 18.ix.1923 (AD 966071090); Mile End, E. H. Ising, 1.x.1931 (AD 966071073); Mt. Lofty, E. H. Ising, 21.xi.1934 (AD 966071092); white- and pink-flowered forms, Mile End, E. H. Ising, x.1939 (AD 966080464); Crafers, E. H. Ising, 24.ii.1971 (AD 97115008); 15 km south-south-east of Bascombe Well H.S., E. N. S. Jackson 1197, 7.x.1967 (AD 97314308); Oraparrina National Park, E. N. S. Jackson 1787, 15.ix.1971 (AD 97215318); Mambray Creek, V. Jaegermann, 30.ix.1960 (AD 96702040, 96702128); Cape Jervis, V. Jaegermann 7, 13.x.1969 (AD 97020089); Hope Valley, J. Johnsson 64, 22.ix.1969 (AD 97106389); Mitcham, Just, 19.ix.1949 (AD 966050229); Flinders Range, M. Koch 586, x.1901 (NSW); Field Naturalists Reserve, MacLaren Flat, D. N. Kraehenbuehl 1971, 2.xii.1966 (AD 96725329); Aldinga, D. N. Kraehenbuehl 2369, 9.ix.1969 (AD 96948075); Aldinga, D. N. Kraehenbuehl 2375, 9.ix.1969 (AD 96948069); white-flowered form, RAAF Base, Salisbury, I. H. S. McDonald, 19.x.1960 (ADW 23406); Goodwood, J. R. Maconochie, 9.ix.1968 (NT 13858); between Port Lincoln and Coffins Bay, J. H. Maiden, i.1907 (NSW 137387); Hazelwood Park, H. Martin, date ? (AD 966072203); white-flowered form, Beetaloo, Mary Mills, x.1908 (AD 97621120); Klemzig, A. E. Orchard, 10.ii.1965 (AD 966050098); 8 km east of Burra, R. D. Pearce 14c, 13.x.1974 (ADW 45616); Morphett Vale, R. A. Perry, ix.1943 (CANB 18417); Renmark, M. E. Phillips, 1.ix.1962 (CBG 017274); near Port Augusta, M. E. Phillips, 3.ix.1962 (CBG 010003, 015656; NT 26629); Mt. Pleasant road in the Mt. Crawford Forest, M. E. Phillips, 13.xi.1962 (CBG 013306); Blanchetown, Pottir, 1870 (MEL); Ferguson Recreation Park, Stonyfell, K. Preiss 83, 9.ix.1972 (AD 97247363); Fullarton, R. K. Pritchard, 19.ix.1948 (AD 966050199); Eden Hills, R. W. Purdie 116, 29.ix.1936 (AD 97106214); Adelaide foothills, J.R., 27.vii.1965 (AD 97107331); Georgetown, Mrs. A. F. Richards, vi.1893 (MEL); Springfield, E. L. Robertson, 24.ix.1952 (ADW 7863); Moolooloo Station, between Blinman and Beltana, R. S. Rogers, x.1915 (NSW 137386); 11 km south of Wilpena Pound, K. D. Rohrlach 633, 9.x.1959 (AD 96046047); Gawler, L. A. Rowe, date ? (AD 966050328); Mitcham, C. P. S., ix.1944 (AD 966050228); Netherby, R. Schodde 686, x.1955 (AD 96027089); Naracoorte, K. R. Smith, 25.ix.1973 (KTRI; MEL*); Waterfall Gully, Mt. Lofty Range, R. V. Southcott B 570, 30.xi.1968 (AD 97050005); white-flowered form, Caltowie, W. Spafford, x.1917 (AD 97613163); southern suburbs, J. H. Steward, ix.1964 (ADW 37854); Clovelly Park, J. H. Steward, 12.x.1965 (ADW 37328); Brighton, G. W. Swincer, ix.1964 (ADW 37854); Waite Institute, D. E. Symon, 14.x.1959 (ADW 21577); Angepena, D. E. Symon 3071, 12.x.1964 (ADW 29021); east of Mortlock Experiment Station, Mintaro,

D. E. Symon 3923, 16.xii.1965 (ADW 30850; CANB 168114); Mortlock Experiment Station Mintaro, *D. E. Symon* 4419, 9.xi.1966 (ADW 32082; CANB 209658); eastern edge of Aroona Valley, Oraparinna National Park, *D. E. Symon* 7286, 13.ix.1971 (ADW 39786; CANB 246387); junction of the Brachina and Elatina Creeks, Oraparinna National Park, *D. E. Symon* 7387, 15.ix.1971 (ADW 39785); Blinman Road, Oraparinna National Park, *D. E. Symon* 7466, 16.ix.1971 (ADW 39787); floor of the Aroona Valley, Oraparinna National Park, *D. E. Symon* 7536, 19.ix.1971 (ADW 39788); Scorpion Springs Conservation Park, near Pinnaroo, *D. E. Symon* 8773, 21.x.1973 (ADW 43203); Carrapee Hill, Eyre Peninsula, *D. E. Symon* 8951, 15.ix.1974 (ADW 44893); Lower Coorong, south of Banff, *D. E. Symon* 10521, 11.x.1975 (ADW 47988); white-flowered form, Moralana Valley, Northern Flinders Range, *G. F. Telfer* 96, 28.ix.1968 (AD 96930124); fasciated form, 2 km north of Bute, *J. Z. Weber* 57, 12.x.1966 (AD 96647201-3); Yudnapiinna road, 20 km west of the Port Augusta-Alice Springs road, *J. Z. Weber* 76, 24.x.1966 (AD 96648309); Wantapilla Bore, eastern end of the Everard Ranges, *J. Z. Weber* 108, 26.x.1966 (AD 96648341); Mt. Lofty Botanic Garden, not cultivated, *J. Z. Weber* 383, 28.xi.1966 (AD 96706016); white-flowered form, Mt. Lofty Botanic Garden, not cultivated, *J. Z. Weber* 395, 1.xii.1966 (AD 96706027); 3 km north of South Gap, Lake Torrens Plateau, *J. Z. Weber* 1278, 3.ix.1968 (AD 96913015); Titree Well, central Oraparinna National Park, *J. Z. Weber* 2454, 14.ix.1971 (AD 97150342); 6 km south of Blanchetown, *J. Z. Weber* 3535, 23.iii.1973 (AD 97339045); Brookfield Zoo Wombat Reserve, 13 km west of Blanchetown, *J. Z. Weber* 3565, 2.x.1973 (AD 97347360); Smithfield, *C. B. Wells*, 19.ix.1948 (ADW 6376); 33 km south of Port Wakefield, *D. J. E. Whibley* 1624, 12.x.1966 (AD 97013238); 25 km west of Whyalla on the Kimba road, *D. J. E. Whibley* 2026, 28.viii.1967 (AD 96742046); Chambers Gorge, Flinders Range, *D. J. E. Whibley* 4023, 12.ix.1973 (AD 97348156); 20 km west of Cook, *P. Wilson* 1700, 16.ix.1960 (AD); Oodnadatta, *Woskett*, 14.x.1955 (AD 966140051); Brown Hill Creek Reserve, *D. A. Wright*, 18.v.1969 (AD 97107375).

Queensland—Pittsworth, *W. L. Archer*, 19.x.1933 (BRI 215678); Goomeri, *W. T. Banks*, viii.1955 (BRI 215664); Chinchilla Road, 6 miles south of Mundubbera, *W. J. Bisset*, 12.x.1970 (BRI 102705); Birdsville, *D. E. Boyland*, 27.ix.1966 (BRI 072726); Wallangarra, *T. J. Bowen*, xi.1952 (BRI 215679); Rosewood, *G. Brown*, 6.x.1960 (BRI 027268); Lowood, *V. Buckley*, 7.xi.1963 (BRI 043520); Cambooya Shire, *per Cambooya Shire Council*, 12.x.1954 (BRI 215675; CANB 30360, 30361); Junabee, near Warwick, *T. Carey*, 21.xi.1972 (BRI 149864); 1-6 km south of Munbilla, *B. Carmichael*, 1.xi.1972 (BRI 149858); Wonglepong, via Tamborine, *J. Caswell*, 15.xi.1963 (BRI 043518); Marlborough, *H. Collins*, 4.xii.1950 (BRI 215666); Laidley district, *E. C. Darley*, ix.1950 (BRI 215682); 6 miles north-west of Coolangatta between West Burleigh and Tallebudgera Creek, *G. P. Donnelly*, 28.x.1969 (BRI 088392); Maleny Parish, *H. G. Dougherty*, 1.x.1974 (BRI 181431, 204030); Gympie, *N. J. Douglas*, xii.1953 (BRI 215660); Grantham, *R. W. Downes*, 6.ix.1956 (BRI 215686); Atherton, *W. J. Draper*, x.1959 (BRI 024448); Sheffield Pastoral Company, 40 km south-west of Taroom, *S. Evans*, 8.x.1973 (BRI 160978); Albert River, near Kerry, *S. L. Everist*, 27.ix.1955 (BRI 215683; CANB 36253); Russell Island, *S. L. Everist*, 11.v.1959 (BRI 026639); fasciated form, Chatsworth, Gympie district, *R. R. Fanning*, 12.xii.1958 (BRI 013338); Offham, between Wyandra and Cunnamulla, *N. Geary*, 16.x.1954 (BRI 215669); Crows Nest, *K. J. Gleeson*, 29.ix.1958 (BRI 012186); "Wylie", Wambo, Chinchilla district, *A. M. Gray*, x.1956 (BRI 215674); Raceview, Ipswich, *J. Griffiths*, 18.x.1960 (BRI 025952); Tara, *R. J. Haddock*, 23.x.1964 (BRI 060277); "Glenbrook", 8 km south of Millmerran, *E. M. Hall*, 8.x.1971 (BRI 140105, 140106); Cloyna, 30 miles north of Kingaroy, *E. R. Hancock*, 20.ix.1968 (BRI 077423); Mount Lindsay, via Rathdowney, *E. Hardgrave*, date? (BRI 187821); Pilton Valley, *D. Harrison*, 2.x.1957 (BRI 006272); Rossmoya, near Rockhampton, *O. L. Hassell* 3, x.1947 (BRI 215667); Zillmere, *R. Hederton*, ix.1920 (BRI 215684); Inverlaw, 8 miles from Kingaroy, *S. R. Hetherington*, 18.x.1950 (BRI 215663); Goomboorian, *N. V. Hibberd*, 23.iii.1971 (BRI 114040); Monte Cassin, Kilcoy,

D. Kennedy, viii.1966 (BRI 063040); *Indooroopilly*, *B. Lebler*, i.viii.1969 (BRI 086702); *Conondale*, *P. E. Luck*, 17.xi.1970 (BRI 109931); *Atherton*, *J. Mann*, 30.ix.1954 (BRI 215665); *Institute of Technology*, *Toowoomba*, *J. Mann*, 29.x.1969 (BRI 088407); *Tallebudgera Creek*, 8 miles north-north-west of *Coolangatta*, *D. Marshall*, 8.x.1969 (BRI 090537); *Kingaroy*, *N. Michael*, x.1945 (BRI 102226); *Tallegalla*, via *Rosewood*, *S. Middleton*, 11.xi.1955 (BRI 215687); *O'Bil Bil*, 8 miles north-west of *Munduberra*, *E. Mollenhauer*, 16.x.1964 (BRI 058504); *Dalby*, *J. Morgan*, 18.x.1960 (BRI 027151); *Wutul*, *Cooyar Line*, *E. A. Munt*, ix.1950 (BRI 215673); 12 miles south-east of *Maryborough*, *R. H. Price*, 11.xii.1969 (BRI 089369); *Pittsworth*, *M. Ramsay*, xi.1930 (BRI 215661); *Darling Downs*, *R. Roe*, ix.1938 (CANB 7712); *Lamington*, via *Beaudesert*, *K. Rohan*, 12.xii.1950 (BRI 215680); *Chinchilla*, *J. P. Ryan*, 9.x.1959 (BRI 027536); *Beaudesert*, *A. Shirley*, 18.xii.1950 (BRI 215685); *Crows Nest*, *N. Stark*, 19.ix.1969 (BRI 087469); *Tewantin*, *A. R. Taylor*, 11.ix.1966 (BRI 063124); *Town Reserve*, *Ballandean*, *D. Taylor*, 27.x.1958 (BRI 012975); *Pelican*, *Chinchilla*, *per P. W. Taylor*, 12.x.1956 (BRI 052358, 215672, CANB 38885); *Wamuran Basin*, 7 miles north-west of *Caboolture*, *P. W. Taylor*, 13.xii.1965 (BRI 062240); 1.5 km east of *Oakey*, *K. J. Thomas*, 27.viii.1973 (BRI 158668); 0.5 miles south of *Landsborough Railway Station*, *H. S. Tutt*, 15.x.1970 (BRI 101950); 14 miles south of *Gympie*, *H. S. Tutt*, 9.xi.1970 (BRI 109930); *Harristown*, *Toowoomba*, *C. T. White*, 19.x.1944 (BRI 215677); *Boonah*, *A. Winterton*, xi.1956 (BRI 215681); *Lawgi*, 15 miles south-east of *Biloela*, *I. J. L. Wood*, 1.xi.1956 (BRI 215668); "*Myrtlehome*", *Freestone*, via *Warwick*, *R. S. Young*, x.1921 (BRI 215670).

New South Wales—*Warren*, *F. D. Antill*, x.1921 (NSW 137444); *Tumblong*, *H. C. Anthill*, xi.1915 (NSW 137418); fasciated form, *Cobar*, *Arthur*, x.1930 (NSW 137443); *Deniliquin*, *per Australasian*, 13.x.1897 (MEL); *Bathurst*, *E. Beardwood*, i.1948 (NSW 5864); between *Tumut* and *Yass*, *Bice*, vi.1919 (NSW 137379); *Minore*, *J. L. Boorman*, ii.1899 (NSW 137397); *Nyngan*, *J. L. Boorman*, viii.1903 (NSW 137445); *Dubbo*, *J. L. Boorman*, x.1906 (NSW 137396); *Jingellic*, *Upper Murray*, *J. L. Boorman*, x.1916 (NSW 137413); *Terrigal*, *W. Boyce*, 3.iv.1948 (NSW 137355); *Mt. Russell*, *E. Breakwell*, 20.i.1915 (NSW 137429); *Bowna*, *J. Calvert*, 8.xii.1930 (CANB 7716); *Dubbo*, *R. H. Cabbage* 1079, 13.x.1904 (NSW 137403); *Dubbo* *R. H. Cabbage*, 13.x.1904 (NSW 137404); *Cotter River*, *Australian Capital Territory*, *T. G. Campbell*, 13.x.1935 (CANB 15593); 2 miles south-west of *Jugiong*, *J. Carne*, 11.x.1948 (CANB 22856); 25 miles from *Hay* towards *Gunbar*, *E. J. Carrol*, 14.ix.1965 (CBG 027805); *Carcoar*, *P. J. Cheffins*, ix.1915 (NSW 137374); *Tullamore*, *A. B. Chislett*, x.1913 (NSW 137399); *Huskinson*, *Jervis Bay*, *Christisson*, 21.xi.1932 (NSW 137365); *Botanical Gardens*, *J. Collings*, xi.1938 (CANB 7713); *Urisino*, *E. F. Constable*, 15.ix.1947 (NSW 137436); *Tibooburra*, *E. F. Constable*, 24.x.1949 (NSW 10740); *Paldrumatta Bore*, *J. Corbett*, x.1904 (NSW 137437); *Doonside*, *R. Coveny*, 5.xii.1965 (NSW 137356); 2 miles south of *Mendooran* towards *Dubbo*, *R. Coveny* 2494, 27.xi.1969 (NSW); *Kings Plains*, *I. Croft*, xi.1948 (NSW 137430); *Rowena*, *G. M. Cunningham & P. L. Milthorpe* 1223, 21.ix.1973 (NSW); white-flowered form, 43 km west of *Cobar*, *G. M. Cunningham & P. L. Milthorpe* 1238, 22.ix.1973 (NSW); *Hall*, *Australian Capital Territory*, *E. D'Arny* 44, 23.x.1959 (CANB 70185); *Deniliquin*, *A. F. Davies* ACB 39250, i.1961 (NSW); *Hall*, *Australian Capital Territory*, *H. Doing*, ix.1964 (CANB 160645); between *Canberra* and *Braidwood*, *C. Dunlop* 173, 27.x.1968 (CBG 048462); *Temora*, *J. W. Dwyer*, x.1915 (NSW 137410); *Broken Hill*, *J. Eastburn*, viii.1951 (NSW 137433); *Yass*, *H. A. Edwards*, 12.xii.1913 (NSW 137376); *Gilgandra Road*, 24 km south-south-east of *Coonamble*, *S. L. Everist*, 7.xii.1969 (BRI 205139); *Curban*, junction of the *Castlereagh River* and the *Terrabile Creek*, *S. L. Everist*, 7.xii.1969 (BRI 205152); *Tooraweenah*, *L. S. Finch*, iv.1948 (NSW 122679); *Botanic Gardens*, *Sydney*, *N. C. Ford*, 3.xii.1954 (NSW 137359); *Tomah to Cockatoo*, *Holbrook district*, *W. Forsyth*, xi.1900 (NSW 137416); *Pennant Hills*, *L. Fraser*, 1934 (NSW 137358); *Tarana*, *L. Fraser & J. Vickery*, xi.1941 (NSW 137375); *Bathurst district*, *E. Friend*, date ? (NSW 137371); *Cum-*

beroona, *Gamble*, xii.1905 (MEL); few miles east of Goulburn on the Windellama Road, C. D. Gee, v.1969 (NSW 137377); Hillston district, *per Glenfield Veterinary Research Station*, 18.v.1939 (NSW 137442); white-flowered form, Molong district, *per Glenfield Veterinary Research Station*, 5.xi.1942 (NSW 137395); Limbri-Kootingal, near Tamworth, R. H. Goode 58, 30.x.1954 (NSW); near Moonbi, R. H. Goode 151, 13.xi.1954 (NSW); Inverell area, M. Gray 3031, x.1954 (CANB 94125); Armidale township, M. Gray 3447, 3.i.1956 (CANB 94126); Murrumbidgee, *Hanbridge Esq.*, 1875 (MEL); Boorowa, A. Hancock, xii.1920 (NSW 137398); Hubba, A. Hannah, ix.1921 (NSW 137354); Cumberoona, via Albury, E. A. Hamilton, xi.1904 (NSW 137421); near Gol Gol, T. Henshall, 23.xi.1968 (NT 46010); white-flowered form, Ardenhall, near Gundy, R. E. Herrington, 23.x.1952 (NSW 137411); Urana, A. L. Hommian, xi.1913 (NSW 137440); Pimpara Creek, between Maude and Oxley, S. Jacobs 1066, 8.ix.1973 (NSW); Fowlers Gap, S. Jacobs 1949, 18.x.1974 (NSW); Fowlers Gap, S. Jacobs 2249, 8.x.1975 (NSW); Berrigan, W. Jermyn, viii.1912 (NSW 137438); Broken Hill, L. A. S. Johnson, 29.viii.1946 (NSW 137434); Camden Park, L. A. S. Johnson, 15.xi.1949 (NSW 137361); Dalgety, H. C. E. Kelly, 30.xi.1948 (NSW 137378); between Yass and Albury, K. H. L. Key, iii.1941 (CANB 11327); Gunnedah, J. W. Kuhl, x.1921 (NSW 137432); Canberra, R.M., viii.1934 (BR1 052359); white-flowered form, Dights Hill, near Albury, E. J. McBarron 2452, 27.x.1948 (NSW); Black Mountain, Australian Capital Territory, P. McDonnell 203, 17.xii.1969 (CBG 041887); Woodenbong, A. H. McGregor, x.1949 (NSW 137367); "Bonnie Doon", Brungle, via Gundagai, D. J. McGruen, viii.1924 (NSW 137417); white-flowered form, Cheesemans Creek, 17 miles west of Orange, H. S. McKee, 24.x.1952 (NSW 137406); O'Connor, Australian Capital Territory, H. S. McKee 8865, 17.xii.1961 (CANB 109765; NSW); Canberra, H. S. McKee 9595, 30.ix.1962 (NSW); between O'Connell and Bathurst, P. W. Michael, 7.xi.1973 (K; KTR1); Rydal, P. W. Michael, 7.xi.1973 (K; KTR1); Reids Flat, near Cowra, P. W. Michael, 8.xi.1973 (K; KTR1); Spring Hill, near Orange, P. W. Michael, 8.xi.1973 (K; KTR1, 2 sheets); between Cowra and Young, P. W. Michael, 9.xi.1973 (K; KTR1); Tarago township, P. W. Michael, 24.xi.1973 (K; KTR1); near Barooga between Berrigan and Barooga, C. W. E. Moore M994, 20.x.1948 (CANB 54588); between Uriarra and Talacas, C. W. E. Moore 1955, 11.iii.1952 (CANB 54589); 62 miles east of Cobar on the Barrier Highway, C. W. E. Moore 3907, 19.ix.1966 (CANB 187268); 65 miles from Cobar on the Louth Road, C. W. E. Moore 7171, 14.x.1975 (CANB 249950); Deniliquin, J. B. Moore, 23.x.1940 (CANB 7715); Broken Hill, A. Morris 494, x.1920 (ADW 14791); Broken Hill, A. Morris, xi.1920 (BR1 215662); Broken Hill, A. Morris, xii.1920 (NSW 137435); Tocumwal, A. Morris, 27.ix.1926 (ADW 14775); Broken Hill, A. Morris, iv.1928 (ADW 14776); C.S.I.R.O. grounds, Canberra, K. Mowle 144, 4.xi.1963 (CANB 128872); Cudal, *Noxious Weeds Inspector*, xi.1920 (NSW 137393); Murrumbidgee River flats, Junee district, J. B. Nugent, 14.xii.1922 (NSW 137419); Zara, Wanganella, E. Officer 365, xii.1918 (NSW 137441); pink-flowered form, Wyalong district, G. H. Officer, 29.x.1955 (NSW 137409); Ungarie, G. H. Officer, 31.x.1955 (NSW 137407); flowers almost white, Ungarie, G. H. Officer, 31.x.1955 (NSW 137408); Rockley, G. H. Officer, 1.ii.1961 (NSW 137373); Rockley, G. H. Officer, iv./v.1961 (NSW 137372); Pee Dee, Macleay River, M. O'Sullivan, 15.x.1936 (NSW 137369); a few miles east of Tocumwal, M. E. Phillips, 30.xi.1961 (CBG 003361); 26 miles from Urana towards Jerilderie, M. E. Phillips, 25.x.1966 (CBG 016972); white-flowered form, Albury, C. M. Piggin, spring, 1969 (K; KTR1; MEL); rosette, grown at KTR1 from seed collected at Corowa, C. M. Piggin, 13.iii.1973 (KTR1; MEL*); flowering plant, grown at KTR1 from seed collected at Corowa, C. M. Piggin, 13.iii.1973 (KTR1; MEL*; NSW 137424); roadside, Hopefield, C. M. Piggin, 24.iv.1973 (K; KTR1, 3 sheets); waste area, Hopefield, C. M. Piggin, 24.iv.1973 (KTR1; NSW 137427); roadside 1, Corowa, C. M. Piggin, 22.x.1973 (KTR1; MEL*; NSW 137426); roadside 2, Corowa, C. M. Piggin, 22.x.1973 (K; KTR1; NSW 137428); waste area, Hopefield, C. M. Piggin, 22.x.1973 (KTR1; MEL*; NSW 137423); pasture, Hopefield, C. M. Piggin, 22.x.1973

(KTRI; MEL*; NSW 137425); Western Highway north of Holmwood, near Cowra, C. M. Piggin, 26.viii.1976 (KTRI; MEL); Black Mountain, Canberra, R. Pullen 4285, 19.x.1968 (CANB 184172, 184173); Holbrook, C. Pulton, xi.1920 (NSW 137422); Broken Hill, L. Richley 1214, viii.1973 (AD 97405153); north of Albury, F. A. Rodway, 25.x.1933 (NSW 137420); Bomaderry, F. A. Rodway, 16.viii.1947 (NSW 137360); Bolong, Shoalhaven, F. A. Rodway, 10.x.1949 (NSW 137363); near Young, J. Rodway, x.1936 (NSW 122682); Binnaway, H. Salasoo 2189, 3.i.1962 (NSW); Grenfell, H. Salasoo 2953, 29.xii.1964 (NSW); Kyogle, *per Shire Clerk*, xi.1949 (NSW 137366); Muswellbrook, *per Shire Council*, xii.1947 (NSW 137412); Kyogle, *per Shire Council*, x.1949 (NSW 137370); Cudal, A. H. Shirwin, x.1921 (NSW 137401); Geurie, W. Smith, xi.1914 (NSW 137394); Centennial Park, Sydney, K. Solling 590, 22.xi.1973 (NSW 137357); 25 miles east of Jerilderie, V. R. Squires, 2.x.1969 (KTRI, 2 sheets; MEL*; NSW 137448); white-flowered form, 25 miles east of Jerilderie, V. R. Squires, 2.x.1969 (KTRI); Dubbo, *Stock Inspector*, ix.1921 (NSW 137405); Upper Horton, *per Stock Inspector*, xi.1948 (NSW 137431); Woodstock, W. Straatmans 5, 21.x.1958 (CANB 58211); fasciated form, Gilgandra, W. Straatmans 12, 22.x.1958 (CANB 58210); between Mt. Hope and Lake Cargellico, W. Straatmans 24, 28.x.1958 (CANB 58208); 6 miles west of Grenfell, W. Straatmans 30, 30.x.1958 (CANB 58209, 58244); Kyogle district, R. Vane, 20.x.1954 (NSW 137368); Barooga, J. Vickery, 11.x.1949 (NSW 137447); white-flowered form, Barooga, J. Vickery, 11.x.1949 (NSW 137439); Bega, N. Wallace, xi.1914 (NSW 137364); Murrumburrah, R. B. Wallace, v.1911 (NSW 137414, 137415); Young district, C. M. Western, x.1921 (NSW 137402); Stewarts Book, Upper Hunter, H. L. White, x.1919 (NSW 137400); Wee Waa, W. E. White, xi.1921 (NSW 137446); Castle Hill, Wilkinson, 15.x.1937 (NSW 137362); Cocopara Nature Reserve, 225 km north-north-west of Albury, J. H. Willis, 30.ix.1969 (MEL 503272).

Victoria—Yarrawonga Shire, Anon. x.1906 (MEL); Yarra, Anon., date ? (MEL); Melbourne Botanic Garden, Anon., date ? (MEL); Kyneton, Argyle, 4.xii.1912 (MEL); Richmond Park, Richmond, H. I. Aston 168, 18.xi.1958 (MEL); Apsley, J. Carruthers, 1894 (MEL); white-flowered form, Cobram, R. R. Chomley, x.1915 (MEL); Puckapunyal, C. Davis 14, xii.1942 (NSW 137392); Shire of Towong, *Department of Agriculture*, 13.xii.1906 (MEL); Geelong, Edwards, xii.1889 (NSW 137391); Upper Murray, 40 miles east of Albury, S. B. Elliott, xi.1924 (MELU 17480); Upper Murray, *per E. F. Fricke*, date ? (ADW 1845); Tongala, E. P. Furze, 14.ix.1973 (K; KTRI; MEL); Echuca, E. P. Furze 3.x.1973 (K; KTRI); 20 miles from Pinnaroo towards Ouyen, D. J. Groot Obbink 9, 29.xii.1965 (CBG 024546; NT 40176); Eltham, Mrs. E. M. Harrison, x.1955 (MELU 17481); Warby Range, E. H. Ising 25, 14.x.1972 (MEL); Heywood Parish, Portland, R. King, 26.xi.1974 (KTRI; MEL); Corryong, Lanyon, xi.1906 (MEL); Dookie Agricultural College, D. L. Mall, xi.1933 (CANB 7714); Rheola, 12 miles south-west of Inglewood, M. J. Mason, xi.1960 (MEL); Yarra, F. Mueller, date ? (MEL); Seppelt property, Mt. Martha, B. Murray, xi.1973 (K; KTRI; MEL); Tongala, R. H. Nation, 9.x.1973 (KTRI); white-flowered form, Wodonga, C. M. Piggin, v.1969 (KTRI; MEL*; NSW 137390); fasciated form, Rutherglen, C. M. Piggin, xii.1969 (KTRI); "Gooramadda Park", Rutherglen, C. M. Piggin, 26.iv.1973 (K; KTRI, 2 sheets; MEL); Ensay, near Bairnsdale, C. M. Piggin, 15.x.1974 (KTRI; MEL 502814, 502815); fasciated form, Gooramadda, via Rutherglen, C. M. Piggin, 21.x.1974 (KTRI; MEL); 10 km from Beechworth towards Chiltern, C. M. Piggin, 14.ix.1976 (KTRI; MEL); Wells Road, 10 km north of Frankston, C. M. Piggin, 4.x.1976 (KTRI; MEL); Moe, A. W. Read, xi.1973 (KTRI; MEL*; NSW 137389); Benalla, P. St. John, 28.viii.1908 (MEL); Durham, Shire of Gordon, W. Sinclair, xi.1921 (MEL); Teal Point, E. C. Ward, received 27.x.1920 (MEL); Cobram, C. Warner, ix.1955 (CANB 136543); Dookie Agricultural College, C. Warner, xi.1955 (CANB 136544); fasciated form, Seymour, J. Wheildon, 1974 (KTRI); 4 miles south of the 65 mile post on the Sturt Highway west of Mildura, J. H. Willis, 3.ix.1948 (MEL).

Tasmania—Huon Road, Anon., xi.1957 (HO 7800); Franklin—Southport, W. M. Curtis, 8.xii.1958 (HO 7799); north-west coast, B. Eastbrook, xi.1953

(HO 7801); Rosevears, T. T. *Hague*, iii.1973 (K; KTRI); Meadowbanks, Glenora, D. I. Morris, 21.iii.1973 (KTRI; MEL*); South Arm, L. Rodway, xii.1905 (HO 7796); Hobart, L. Rodway, xii.1916 (HO 7792); Newtown, L. Rodway, date? (HO 7803); Cobbs Hill, Bridgewater, E. M. Smith, 16.xii.1946 (HO 7802).

Norfolk Island—Norfolk Island, J. D. McComish 241, 13.x.1939 (NSW)

E. vulgare L., Sp. Pl. 139 (1753)

Synonyms: *E. asturicum* Lacaita, *Cavanillesia* 1 : 8 (1928).

E. hispanicum Asso, Syn. Arag. Mant. 162 (1781).

E. lacitae Sennen, *Cavanillesia* 2 : 26 (1929) in obs.; and Bol. Soc. Iber. 29 : 43 (1930).

E. lycopsis L., Fl. Anglica 12 (1754) pro parte (lectotype incl.).

E. pustulatum Sibth. & Sm., Fl. Graec. Prodr. 1 : 125 (1806)

E. tuberculatum Gilib., Exerc. Phyt. 41 (1972) nom. illeg., non Hoffmanns & Link (1809).

E. vulgare subsp. *asturicum* (Lacaita) Klotz, Wiss. Zeitschr. Univ. Halle 11 : 704 (1962).

E. vulgare var. *pustulatum* (Sibth. & Sm.) Rouy in Rouy, Foucaud & Camus, Fl. France 6 : 113 (1900).

Common name: Viper's Bugloss.

Erect, hispid biennial, or sometimes annual, 20–100 cm tall, with one spike-like flowering stem or sometimes quite branched; *indumentum* of sparse, stout, appressed to patent, tubercule-based white setae (1–3 mm) and dense underlayer of soft, deflexed, appressed, white hairs. Basal and lower cauline leaves 50–150 x 10–20 mm, narrowly oblanceolate, attenuate to petiolate at the base, with no apparent lateral veins; upper cauline leaves narrowly elliptic to lanceolate, sessile. Calyx 5–7 mm; corolla 9–12 mm, infundibuliform, blue to bluish-violet, hairy—especially on the veins and margins; 4 stamens long-exserted and 1 short-enclosed; filaments reddish-blue; pollen bluish-grey; style hairy. Nutlets 1.5 x 2.5 mm, more or less triquetrous, rugose, brownish-grey.

According to Lacaita (1919) and Gibbs (1971, 1972), *E. vulgare* is a very variable species which requires detailed study throughout its area of distribution. Some authors (e.g. Willkomm & Lange, 1870; Boissier, 1879; Lacaita, 1919) have separated *E. pustulatum* Sibth. & Sm. as a distinct species. Australian material, however, quite constantly fits the description given above.

SPECIMENS EXAMINED:

South Australia—Mt. Gambier, ex Department of Agriculture 253, 29.ii.1960 (ADW 21518); Millicent, ex Department of Agriculture 5962, 1.ii.1972 (ADW 40366); Clare, A. E. Ophel, 12.xii.1943 (ADW 4986); Georgetown, Mrs. A. F. Richards, 1893 (MEL); grown at the Waite Agricultural Research Institute from seed collected at Clare, D. E. Symon, 23.xii.1960 (ADW 23407); near Clare showgrounds, D. E. Symon 3899, 16.xii.1965 (AD 96733008; ADW 30851).

New South Wales—Rendezvous Creek District, 3 miles north of Boboyan H.S., Australian Capital Territory, L. G. Adams 544A, 17.ii.1963 (CANB 152068); Mannus Valley, Tumbarumba district, Anon., iv.1958 (NSW); between Oberon and Tarana, Anon., date ? (NSW 137469); Tarana, C. Austin, i.1941 (NSW 137467); Bathurst, E. Beardwood, i.1948 (NSW 5862); Murrumbucca Road, near Cooma, J. Beeton, 13.iii.1962 (CBG 020299, 020300); Bathurst, Brett, xii.1914 (NSW 5861); Bathurst, C. R. Brett, xii.1916 (NSW 137466); Point Hutt, Murrumbidgee River, Australian Capital Territory, N. T. Burbidge 7582, 6.ii.1966 (CANB 167691; NSW); Bell, C. Burgess, 29.xi.1958 (CBG 009426); cultivated, Sydney Botanic Gardens, G. Chippendale, 20.xii.1938 (NSW); Braidwood, J. Cole, 30.xi.1945 (NSW 137453); Winburndale Creek, Glanmire, E. F. Constable, 15.iii.1955 (NSW 31203); Mt. Boyce, 3.4 km south-east of Mt. Victoria, R. Coveny 7365, R. Barry, and K. Wilson, 27.i.1976 (NSW); Kings Plains I. Croft, xi.1948 (NSW 137457); Tumbarumba, J. W. Cunningham, ii.1910 (NSW); Grafton, W. H. Darragh, i.1949 (NSW 137450); Wyndham, H. Doing, 29.xi.1963 (CANB 160641); Tarana, L. Fraser and J. Vickery, xi.1941 (NSW 137459, 137460); Bathurst district, E. Friend, date ? (NSW 137468, 137473); Goulburn, A. C. Gibson, x.1934 (NSW 137454); Cooma, M. Gray 4731, 22.ii.1960 (CANB 76984); Tharwa Bridge, Murrumbidgee River, Australian Capital Territory, M. Gray 5011, 3.ii.1961 (CANB 93237; NSW); Rivett, Australian Capital Territory, M. Gray 6506, 10.ix.1971 (CANB 211063, 211064); Tumut district, C. S. Jepson, 14.xii.1953 (NSW 137458); Orange, per R. C. Madsen, 22.xii.1947 (NSW 5863); Coxs River to Fish River and Sidmouth Valley, J. H. Maiden and R. H. Cambage, iv.1909 (NSW); Kameruka, P. Michael, 29.xi.1963 (CANB 135838, 135878); between Tarana and O'Connell, P. W. Michael, 7.xi.1973 (KTRI; MEL*); Blayney, P. W. Michael, 8.xi.1973 (K; KTRI); Tarago, P. W. Michael, 24.xi.1973 (K; KTRI); Glen Innes, J. B. Noonan, ii.1949 (NSW 137451); Rockley, G. H. Officer, viii.1961 (NSW 137472); Bathurst Experiment Farm, Peacock, x.1910 (NSW 137470); Monaro Highway, G. Perry, i.1975 (PERTH); Western Highway, near Carcoar, C. M. Piggin, 26.viii.1976 (KTRI; MEL); 5 miles north of Cooma, R. Pullen 4007, 30.i.1964 (CANB 134002-4); Nevertire, E. K. Rutledge, xii.1916 (NSW 137449); King Highway, about 1 mile north of Nimmitabel, H. Salasoo 2109, 4.i.1961 (NSW); Shoalhaven River, 25 miles north-west of Braidwood, W. Straatmans, 1.xii.1957 (CANB 41252); Bell, W. Straatmans 420, 28.xi.1958 (CANB 94007, 94008); between Daners Gap and Pipers Creek, Kosciusko National Park, J. Thompson 984, 28.i.1971 (NSW); 8 km south-east of O'Connell between Bathurst and Oberon, J. Thompson 1818, 25.viii.1973 (NSW); Mt. Gladstone, west of Cooma, J. Thompson, 27.xii.1973 (NSW 137452); Norway, near Oberon, J. Vickery, 26.i.1953 (NSW 137461).

Victoria—15 km south-west of Portland, B. Copley 1755, 6.i.1968 (AD 96828139); Towong, per *Department of Agriculture*, 18.iii.1901 (MEL. 2 sheets; NSW 137465); Boolara, South Gippsland, per M. Elliot, iii.1890 (MEL); Mornington, Gellie, xii.1954 (MEL); Korumburra, W. Johnstone, 1893 (MEL); Tarragal Parish, Portland, R. King, 12.xi.1974 (KTRI; MEL 502817, 502818); near Myrtleford, Lucas, xi.1883 (MEL); Myrtleford, Lucas, 1883 (MEL); Boneo Road, Mornington Peninsula, B. Murray, xi.1973 (KTRI; MEL*; NSW); Tongala, R. H. Nation, v.1970 (K; KTRI); Tongala, R. H. Nation, ix.1973 (KTRI; MEL*; NSW); Tongala, R. H. Nation, 17.x.1973 (K; KTRI; NSW); Tongala, R. H. Nation, 13.xii.1973 (K; KTRI; NSW); 5 km east of Rye on the Rye Ocean Beach Road, C. M. Piggin, 3.viii.1976 (KTRI; MEL); 4.5 km east of Rosebud on the Boneo Road, C. M. Piggin, 3.viii.1976 (KTRI; MEL); Boneo Road, C. M. Piggin, 22.xii.1976 (KTRI; MEL; MELU 19353); Buckland River, H. B. Williamson, xii.1918 (MELU 17479).

Tasmania—Cambridge, R. A. Black, ii.1912 (HO 7794); Port Arthur, J. Bufton, 1892 (MEL); Merseylea, L. E. Davey, 16.i.1974 (KTRI; MEL*); Astrophysical Observatory, Mt. Rumney, D. I. Morris, 20.vii.1973 (KTRI; MEL*; NSW); Hobart, L. Rodway, i.1916 (HO 7793); North Esk, Launceston, A. Simpson, 1881 (HO 7797).

NOMENCLATURAL CONFUSION

In the past, there have been many mis-identifications of *Echium* material in the Australian herbaria and in the literature. These indicate that reports of all species, unless able to be verified, must be treated with caution. Major examples of mis-applied names are given below:

***E. creticum* L.**, Sp. Pl. 139 (1753): a separate species (Gibbs, 1971, 1972), although the name has been sometimes misapplied to material of *E. plantagineum* (Lacaita, 1919). Early reports of the occurrence of *E. creticum* in South Australia (see pp. 233–4) almost certainly refer to *E. plantagineum*.

***E. italicum* L.**: misapplied to two specimens of *E. plantagineum*, from South Australia (Oodnadatta, Woskett, 14.x.1955) and Western Australia (Denmark, D. A. Herbert, ii.1920). Such mis-identifications in Western Australia probably led Meadly (1956) and Blackall & Grieve (1965) to report incorrectly that *E. italicum* occurs in that state.

***E. lycopsis* L.**, Flora Anglica 12 (1754), without description: this name has been used recently by some authors (e.g. Dandy, 1958; Eichler, 1965; Blackall & Grieve, 1965; Piggin, 1968; Burbidge & Gray, 1970; Chippendale, 1972; Churchill & de Corona, 1972; Willis, 1972; Parsons, 1973) for material of *E. plantagineum*. However, Gibbs (1971) has shown that the name was based indirectly on 1), plants which are not preserved as specimens but, from circumstantial evidence, probably were identical to plants later described as *E. plantagineum* L., and 2), a figure which fairly clearly resembles *E. vulgare*, particularly with respect to the corollas with four long-exserted stamens. The figure has been chosen as lectotype of *E. lycopsis* L. and, as it resembles *E. vulgare* rather than *E. plantagineum*, and because the publication of *E. vulgare* predates that of *E. lycopsis*, the name *E. lycopsis* cannot be used as the correct one for either *E. plantagineum* or *E. vulgare*.

In the Australian Herbaria, most specimens which were labelled *E. lycopsis* are *E. plantagineum*; however, one specimen of *E. vulgare* (between Bathurst and Oberon, J. Thompson 1818, 25.viii.1973) was mis-identified as *E. lycopsis*.

***E. plantagineum* L.**: misapplied to several specimens of *E. vulgare* (Tarana, C. Austin, i.1941; Bathurst, Brett, xii.1914; Bathurst, C. R. Brett, xii.1916; Bell, C. Burgess, 29.xi.1958; Tumbarumba, J. W. Cunningham, ii.1910; Cocks River to Fish River and Sidmouth Valley, J. H. Maiden & R. H. Cambage, iv.1909; Nevertire, E. K. Rutledge, xii.1916; Buckland River, H. B. Williamson, xii.1918) and originally used for the first specimen of *E. italicum* collected in New South Wales (Shire of Coreen, near Corowa, E. Bray, 1914).

E. violaceum L.: this name was first published in the *Mantissa* (42:1767) but has since been discarded as a species name because it is a confusion of *E. rubrum* Jacq. and *E. rosulatum* Lange (Lacaita, 1919; Ewart & Tovey, 1920).

In Australia, early botanists commonly used the name *E. violaceum* for material of *E. plantagineum*. For example, plant descriptions and illustrations confirm that the *E. violaceum* referred to by Ewart and Tovey (1908, 1909) and Davey (1922) is *E. plantagineum*. The plant description, and a Mueller specimen labelled *E. violaceum* (Yarra, F. Mueller, date ?), indicate that Bentham and Mueller's (1869) *E. violaceum* is *E. plantagineum*. The localities of Rutherglen and Gooramadda suggest that Adcock's (1914) *E. violaceum* is *E. plantagineum*. Many other authors (e.g. Maiden, 1905; Black, 1909; Carne, 1924; Audas and Morris, 1925; Black, 1926; Ewart, 1930; Anonymous, 1935; Gray, 1961) actually list *E. violaceum* as a synonym for *E. plantagineum*. Most herbarium specimens labelled *E. violaceum* are *E. plantagineum* (see pp. 231–232).

However, some collectors have misapplied the name *E. violaceum* to material of *E. vulgare* (Braidwood, J. Cole, 30.x.1945; Bathurst Experiment Farm, Peacock, x.1910; Hobart, J. Rodway, i.1916). The collection by Peacock suggests that his earlier report (Peacock, 1904) of *E. violaceum* occurring around Bathurst referred to *E. vulgare*; certainly, his indistinct illustration could easily be *E. vulgare*. The report by Maiden and Cambage (1909) of the occurrence of *E. violaceum* near Coxs River to Fish River and the Sidmouth Valley refers to *E. vulgare* because their specimen collected from there, strangely labelled *E. plantagineum* rather than *E. violaceum*, is in fact *E. vulgare*.

Similarly, Michael (1972) considered that the undescribed *E. violaceum* in William Macarthur's garden at Camden (Anonymous, 1843) was probably *E. vulgare*, presumably on the circumstantial evidence that *E. vulgare* is an earlier introduction than *E. plantagineum* (Michael, 1970). However, it might well have been *E. plantagineum* because the name *E. violaceum* was used most commonly for *E. plantagineum*, and *E. plantagineum* is quite common on the central coast of New South Wales, having been collected at Pennant Hills (1934), Castle Hill (1937), Bomaderry (1947), Terrigal (1948), Camden Park (1949), the Botanic Gardens, Sydney (1954), Doonside (1965), and Centennial Park, Sydney (1973). In contrast, *E. vulgare* is represented by only one collection in the area, from a cultivated plant in the Sydney Botanic Gardens (1938), although it is probably more common on the central coast region than this single collection suggests. It has been observed growing near the Eastwood Railway Station (P. W. Michael, pers. comm., August 1976).

E. vulgare L.: misapplied to several collections of *E. plantagineum* from South Australia (near Yudnapina, J. Z. Weber 76, 24.x.1966; Wantapilla Bore, J. Z. Weber 108, 26.x.1966; near Cook, P. Wilson 1700, 16.x.1960) and New South Wales (Black Mountain, P. McDonnell, 17.xii.1969). Several authors (Maiden, 1916; Moore, 1967; Macoboy, 1972) have also incorrectly applied the name *E. vulgare* to the abundant *Echium* in north-east Victoria and south-east New South Wales, which is in fact *E. plantagineum*. Similarly, early records of the occurrence of *E. vulgare* in South Australia almost certainly refer to *E. plantagineum* (see pp. 233–234).

OVERSEAS DISTRIBUTION

a) **E. italicum**

E. italicum occurs on dry, stony or sandy soils along roads, channels and sea shores, and in pastures throughout Europe (Gibbs, 1972); around the Mediterranean Sea in western Asia and northern Africa (Post, 1896; Blatter, 1919; Post, 1933; Hassib, 1951; Zohary, 1962; Quezel and Santa, 1963; Riedl, 1967); and throughout south-west Russia (Hegi, 1927; Flora URSS, 1953; Gibbs, 1972).

b) **E. plantagineum**

E. plantagineum has been reported as a plant of dry, sandy areas in England and the Channel Islands (Hill, 1760; Smith, 1823; Babington, 1839; Withering, 1845; Perring & Walters, 1962; Gibbs, 1972); throughout Europe (Gibbs, 1972); around the Mediterranean Sea in western Asia and northern Africa (Post, 1896; Tackholm, 1956; Quezel & Santa, 1963); on Madeira and the Canary Islands (Lems & Holzapfel, 1968); in South Africa (Thiselton-Dyer, 1904; Adamson & Salter, 1950; Guillarmod, 1971); in south-west Russia (Flora URSS, 1953; Gibbs, 1972); in the north-east United States (Gleason, 1963) and California (Abrams, 1951; Munz & Keck, 1959); in Uruguay and Argentina in South America (Lorentz, 1878; Roseveare, 1948); and in the North and South Islands of New Zealand (Cheeseman, 1906; Thomson, 1922; Hilgendorf, 1952). It was also found in Canada in Manitoba in 1953 (Scoggan, 1957).

c) **E. vulgare**

E. vulgare occurs on chalky, gravelly or sandy soils on roadsides, in waste places, and in pastures in England, Wales, southern Scotland, the Channel Islands, and eastern Ireland (Hill, 1760; Babington, 1839; Withering, 1845; Perring & Walters, 1962; Gibbs, 1972); throughout Europe (Gibbs, 1972); in South Africa (Phillips, 1951; Guillarmod, 1971); throughout Russia (Hegi, 1927; Flora URSS, 1953; Gibbs, 1972); in Canada, especially in the east (Macoun, 1884; Scoggan, 1950; Jones & Fuller, 1955; Baldwin, 1958; Gleason, 1963; Ferron & Cayouette, 1964; Frankton & Mulligan, 1970); throughout the United States of

America (Gray, 1842; Macoun, 1884; Norton, 1911; Pammel, 1911; Tidestrom, 1925; Steyermark, 1940; Jones & Fuller, 1955; Hitchcock, Cronquist, Ownbey & Thompson, 1959; Radford, Ahles & Bell, 1968; Correll & Johnston, 1970); in Chile in South America (Lopez & Olalquiaga, 1959; Correll & Johnston, 1970); and in the North and South Islands of New Zealand (Cheeseman, 1906; Thomson, 1922; Hilgendorf, 1952). It was reported to be naturalized in Japan at Hokkaido in 1969 (Osada, 1975).

INTRODUCTION, SPREAD AND DISTRIBUTION IN AUSTRALIA

The first introductions of *Echium* into Australia were probably in the 1800s when plants (seeds) were brought intentionally from the British Isles, the Mediterranean region, the Canary Islands, and the Cape region of South Africa (see Cocks, Boyce & Kloot, 1976) to various gardens in Victoria, New South Wales, South Australia and Tasmania. *E. italicum* was listed by Francis (1859) and Schomburgk (1871) as a cultivated plant in the Adelaide Botanic Gardens.

E. plantagineum is probably the species referred to as *E. violaceum* in catalogues of plants growing in the Melbourne Botanic Gardens (Ginn, 1852—mis-spelt *E. violacium*; Mueller, 1858; Guilfoyle, 1883), the Macarthur garden, Camden (Anonymous, 1843), the Darling Nursery, Sydney (Shepherd, 1851), the Sydney Botanic Gardens (Botanic Garden Report, 1857) and the Adelaide Botanic Gardens (Francis, 1859; Schomburgk, 1871). It may also have been the species referred to as *E. creticum* from the Royal Society's Gardens, Hobart (Anonymous, 1867), although *E. creticum* and *E. violaceum* (? = *E. plantagineum*) were recognised as separate species in the Melbourne and Adelaide Botanic Gardens by Guilfoyle (1883) and Schomburgk (1871, 1872).

E. vulgare was listed as a cultivated species at the Sydney Botanic Gardens in 1828, and had been introduced from England in 1820 (Botanic Garden Report, 1828). It was probably also the species referred to as *E. vulgare* Brot.* from the Melbourne Botanic Gardens (Mueller, 1860) and as *E. wierzbickii* Haberle† from the Adelaide Botanic Gardens (Schomburgk, 1873).

Deliberate introduction and spread probably were encouraged by the availability of seed for purchase. For example, Heyne (1882), an Adelaide nurseryman, included *E. creticum* (no doubt, a mis-spelling of *E. creticum*, and possibly *E. plantagin-*

* *E. vulgare* Brot.: Willkomm & Lange (1870) refer *E. vulgare* Brot. to *E. pustulatum* Sibth. & Sm. which, according to Gibbs (1971, 1972), is a synonym for *E. vulgare* L. However, Lacaita (1919) considered that *E. vulgare* Brot. is a synonym for *E. tuberculatum* Hoff. & Link which, according to Lacaita (1919) and Gibbs (1971, 1972), is a separate species.

† *E. wierzbickii* Haberle: a synonym or variety of *E. vulgare* L. according to Lacaita (1919), Bonnier (1926), and Coste (1937).

eum) and *E. violaceum grandiflorum* (probably *E. plantagineum*) in his seed catalogue of flower plants.

Accidental introductions also occurred. Breakwell (1917, 1918) listed *Echium* as an impurity in canary and cummin seed imported into New South Wales from Morocco and France. Spread has also been encouraged by the movement of agricultural produce contaminated with *Echium* seed. *E. plantagineum* has been found in agricultural seed and fodder and in rat poisons made from crushed wheat in Western Australia (Anonymous, 1965; Peirce, 1970), in feed wheat coming into Tasmania (Anonymous, 1955), and in wastes from wool scouring plants in New South Wales (Anonymous, 1941).

a) ***E. italicum***

E. italicum was first collected in New South Wales near Corowa in 1914. Since then, it has been found occasionally along the Corowa to Albury road and near Young (Anonymous,



Fig. 1.—Distribution of *E. italicum* in Australia (based on collection localities of herbarium specimens).

1924; Blakely, 1925; Anderson, 1939; McBarron, 1955; Department of Agriculture of New South Wales Report, 1961). Its rarity is probably due in part to the vigilance of noxious weeds officers in the shires where it occurs.

In South Australia, *E. italicum* was first collected at Caloote and Palmer Hill (Dec. 1909), Mt. Pleasant (April 1912), and Cudlee Creek (Dec. 1916). At Mt. Pleasant, it was considered an undesirable weed (Agricultural Bureau of South Australia Report: Mt. Pleasant, 1912). By 1926, it occurred in the Mt. Lofty Ranges and towards the Murray (Black, 1926). It has not spread greatly since then and now grows occasionally along the eastern scarp of the Mt. Lofty Ranges, mainly on stony, non-arable roadsides and waste areas (D. E. Symon, pers. comm., 1969).

In Western Australia, *E. italicum* has been reported by Meadly (1956) and Blackall & Grieve (1965) to occur sporadically in the south-west. However, these reports appear to have been based on mis-identified specimens of *E. plantagineum* at the Perth Herbarium, and *E. italicum* probably does not occur in the State.

b) *E. plantagineum*

In Victoria reports of *E. violaceum* being naturalized by 1858 (Mueller, 1858; Bentham & Mueller, 1869) and beginning to spread, especially in the north-east around Walwa, the Shire of Towong, and Rutherglen, by the early 1900s (Ewart & Tovey, 1908, 1909; Ewart, 1913; Adcock, 1914; Davey, 1922) probably correctly refer to *E. plantagineum*. Certainly, early collections from Geelong (Dec. 1889), Apsley (1894), the Yarrawonga Shire (Oct. 1906), Corryong (Nov. 1906), the Towong Shire (Dec. 1906), Benalla (Aug. 1908), Kyneton (Dec. 1912), Cobram (Oct. 1915), and Durham, Shire of Gordon (Nov. 1921), mostly labelled *E. violaceum*, suggest that these early reports referred to *E. plantagineum*. The Cobram specimen had white flowers and aroused interest amongst members of the Royal Society of Victoria (Ewart, 1916). The spread of the species apparently caused concern because the plant was declared as a noxious weed, under the name *E. violaceum*, for the Shire of Towong in 1904, the Shire of Maldon in 1908, and the whole of Victoria in 1911. In 1921, it was re-proclaimed under the name *E. plantagineum* (Victorian Government Gazettes: 10 February 1904, p. 509; 19 January 1908, p. 674; 15 February 1911, p. 1271; 18 May 1921, p. 1748). By the 1930s, it was common in the north-east and found to some extent in other localities (Ewart, 1930; Anonymous, 1935). It is now abundant in the north-east and common throughout the State on roadsides, waste areas, and pastures (Piggin, 1968; Churchill & de Corona, 1972; Willis, 1972; Parsons, 1973).

In New South Wales, *E. plantagineum* was reported, under the name *E. violaceum*, to be naturalized by 1859 (Hooker,

1859; Woolls, 1884, 1885; Anonymous, 1891; Moore & Betcher, 1893). Soon after, specimens were collected from the Murrumbidgee (1875), Deniliquin (1897), Minore (Feb. 1899), between Tomah and Cockatoo, near Holbrook (Nov. 1900), Nyngan (Aug. 1903), Paldrumatta Bore (Oct. 1904), Dubbo (Oct. 1904), and Cumberoona (Nov. 1904), and all were labelled *E. violaceum* except the Murrumbidgee specimen which was labelled *Echium*. By 1905, it was spreading around Albury (Maiden, 1905) and the account of its dispersal from there is probably typical of what happened in many areas. Apparently, it was introduced as a garden flower at Cumberoona by a Mr. Paterson in about 1880. It remained as a small patch until about 1897, when it spread through a fence onto a travelling stock reserve and quickly became widespread on stock routes, reserves, and paddocks throughout the district. By 1916, it had been reported from the Upper Murray, Bourke, Nyngan, Wilcannia, Dubbo, Hay and Jingellic (Maiden, 1905; Cambage, 1905; Agricultural Bureau of New South Wales, 1915; Maiden, 1916).

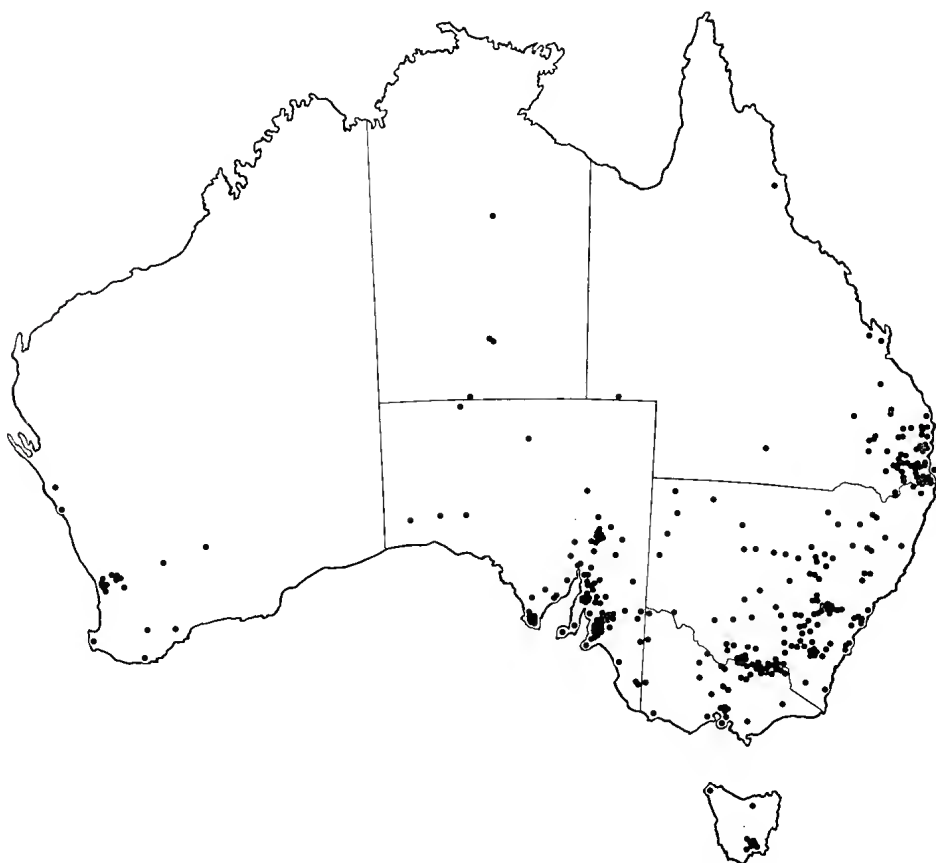


Fig. 2.—Distribution of *E. plantagineum* in Australia (based on collection localities of herbarium specimens).

McBarron (1967) gave a different account of the arrival of *E. plantagineum* in the Albury district, suggesting that it came with German settlers from South Australia after the Land Act of 1861 opened up large areas for selection. This suggestion is reasonable because the plant occurs in Germany, it is considered by Whittet (1968) to be a direct introduction into South Australia from Europe, and it is now widespread in South Australia.

The increasing occurrence of *E. plantagineum* in New South Wales between 1895 and 1934 is reflected in its increasing importance as a weed after it was proclaimed, under the name *E. violaceum*, in the first noxious weeds list of New South Wales, dated 10 July 1909 (Maiden, 1916):

Date	Number of Shires and Municipalities proclaiming it a weed	Position in the 20 most important weeds of N.S.W.	Authority
1895	0	..	Maiden 1915
May, 1914 ..	37	8	Maiden 1915
June, 1915 ..	42	7	Maiden 1915
May, 1917 ..	45	7	Maiden 1917 a, 1917 b
1919	61	?	Maiden 1920
1934	99	?	Anderson 1934

By the 1930s, *E. plantagineum* was widely naturalized in New South Wales (Goodacre, 1938; Carn, 1939; Anderson, 1939) and it is now abundant on the central and south-west slopes and adjacent plains (Department of Agriculture of New South Wales Report, 1961; Whittet, 1968; Willis, 1972), particularly around Albury (Godden, 1955; McBarron, 1955) and the Riverine Plain (Leigh & Mulham, 1965), Inverell and Armidale (Gray, 1961), the coastal and mountain regions around Sydney (Beadle, Evans & Carolin, 1962, 1972), and the Australian Capital Territory (Burbidge & Gray, 1970).

In South Australia, *E. violaceum* was reported to be naturalized by 1889 (Schomburgk, 1889; Agricultural Bureau of South Australia Report: Gladstone, 1889). These reports, and others between 1895 and 1927 (Anonymous, 1906; Agricultural Bureau of South Australia Reports: Gladstone, 1895; Cherry Gardens, 1896; Lucindale, 1897; Northern Branches Conference, 1900; Stockport, 1901; Koolunga, 1904; Johnsburg, 1906; Cradock,

1907; Paskeville, 1907, 1908; Clare, 1910; Annual Congress, 1912; Port Germein, 1912; Spalding, 1914; Wirrabara, 1916; Conference of Upper-Northern Branches, 1918; Laura, 1919; Central Agricultural Bureau, 1927), describing the appearance and spread of *Echium*, *E. vulgare*, *E. creticum*, *E. plantagineum*, bugloss, blue weed, and salvation Jane, especially in the northern districts, probably all referred to *E. plantagineum*. Certainly, specimens collected from Blanchetown (1870), Georgetown (June 1893), the Flinders Range (Oct. 1901), Fullarton (Nov. 1903), Piles Paddock, near Adelaide (Oct. 1904, Oct. 1905), Gladstone (Dec. 1905, Sept. 1906, May 1907, Nov. 1913, Nov. 1920, Dec. 1923), Napperby (Sept. 1906), the Adelaide Plains (Nov. 1906), Hill River (Dec. 1906), between Port Lincoln and Coffins Bay (Jan. 1907), Beetaloo (Oct. 1908), Nuriootpa (Jan. 1912), Hammond (Sept. 1912), Moolooloo Station (Oct. 1915, Oct. 1918), Kapunda (Nov. 1916), Hawker (Oct. 1917), Caltowie (Oct. 1917), Barton (Sept. 1920), Mile End (Sept. 1923), Glen Osmond (Jan. 1924), and Petersburg (June 1924), and the report by Black (1909), suggest that only *E. plantagineum* was common in these areas during this period. By 1926, it grew in most settled districts (Black, 1926) and had, no doubt, spread largely as a result of man's agricultural activities. It was, with *E. italicum*, first proclaimed as a noxious weed for 10 councils in the south-east on 29 July 1943 (South Australian Government Gazette, 29 July 1943, p. 118; Orchard, 1948). Around this time, it was reported to be widespread and still increasing (Wood, 1937; Orchard, 1948; McAuliffe, 1953). Its ability to spread rapidly, establish, and persist on farming land was illustrated at Kybybolite Experiment Station where it was introduced between 1928 and 1933, was widespread over 60% of the Station by 1946, and had not been greatly reduced, despite vigorous control measures, by 1952 (McAuliffe, 1953). It now occurs from the northern semi-arid pastoral areas through the cereal lands to the high rainfall areas of the Adelaide Hills and the south east, and is still spreading (St. George-Grambauer & Rac, 1962; Department of Agriculture of South Australia, Leaflet No. 3987).

In Western Australia, the earliest collections of *E. plantagineum* were made from between Albany and the Swan River (Nov. 1881), the Darling Range (Nov. 1907), Guildford (Sept. 1916), and Darlington (Oct. 1925). The 1881 collection predates the generally believed story that Lady Campbell introduced it as a garden plant to Western Australia, at Broomehill, soon after 1900 during the construction of the Great Southern Railway. It spread rapidly along the railway and, by 1925, occurred extensively in paddocks around Broomehill, Kojunup, and Blackwood. It was sporadic further north and did not occur in the eastern districts (Carne, 1924; Carne & Gardner, 1925; Gardner, 1925, 1930, 1933). By 1956, it was

common throughout the south-west, from Northampton in the north to Esperance in the south (Meadly, 1956; Blackall & Grieve, 1965; Peirce, 1970). It now occurs in the great southern districts as a scattered roadside plant, and in pockets over large areas. In the higher rainfall areas, it is not widely-established. In the eastern, north-eastern, and northern wheatbelt areas, it follows the railway system with major occurrences centred on towns (Pearce, 1972).

In Tasmania, *E. plantagineum* was reported, under the name *E. violaceum*, to be naturalized by 1869 (Bentham & Mueller, 1869; Spicer, 1878), and was first collected at South Arm (Dec. 1905) and Hobart (Dec. 1916). It was probably not widespread by 1912, when *E. vulgare* was proclaimed as a noxious weed, but had obviously increased by 1938 when the "*Echium* species" were proclaimed (D. I. Morris, pers. comm., 15 January 1971). In 1955, it was scattered in the north-east and around the Tamar Valley (Raphael, 1955) and, according to Curtis (1967), is now locally abundant on roadsides and more widespread than *E. vulgare*.

In Queensland, *E. plantagineum* was apparently first recorded at Yandilla in 1916 (White, 1934), although the earliest specimens at the Brisbane Herbarium were collected at Zillmere (Sept. 1920) and Freestone, near Warwick (Oct. 1921). By 1934 it was scattered, mainly in the south-east, and becoming significant as a weed (White, 1934). Everist (1957) reported that it was spreading slowly. It is now common on roadsides and in pastures in the south-east and has been collected as far north as Atherton (Sept. 1954, Oct. 1959) and as far west as Birdsville (Sept. 1966) and Offham (Oct. 1954), appearing mainly where contaminated seed is sown or fed to stock (Department of Agriculture of Queensland Report, 1963).

In the Northern Territory, *E. plantagineum* was first collected near Alice Springs (Oct. 1956). According to Chippendale (1972), it now grows in some cultivated areas and trucking yards around Alice Springs, but is barely naturalized. It has also been collected about 540 km to the north, in the garden of Banka Banka Station (Aug. 1954).

E. plantagineum has been collected (Oct. 1939) on Norfolk Island, but probably is quite rare there.

c) *E. vulgare*

In Victoria, *E. vulgare* was first collected at Myrtleford (Nov. 1883), Boolarra (Mar. 1890), Korumburra (1893), and Towong (Mar. 1901). It was first proclaimed as a noxious weed in 1969, for the whole of Victoria (Victorian Government Gazette, 19 February 1969, p. 330). The plant is now scattered on roadsides and in pastures around Sorrento, Boneo Road, Tongala and Bright, and is abundant around Portland (Piggin, 1968; Churchill & de Corona, 1972; Willis, 1972; Parsons, 1973). Its occurrence around Portland and Sorrento suggests that it

may have arrived in ballast from early ships loading at these ports. Michael (1972) considered that *E. vulgare*, which often occurs around the older-settled areas of New South Wales, may have been an earlier introduction into Australia than *E. plantagineum*, which is more common in recently-settled areas.

The earliest collections of *E. vulgare* in New South Wales were by Maiden and Cambage at Coss River to Fish River and Sidmouth Valley in April 1909; Cunningham at Tumbarumba in February 1910; Peacock and Brett at Bathurst in October 1910, December 1914, and December 1916; and Rutledge at Nevertire in December 1916. However, there was considerable confusion about the identity of these plants. The Maiden & Cambage specimen was labelled *E. plantagineum* on the herbarium sheet but reported (Maiden & Cambage, 1909) under the name *E. violaceum*. Peacock's specimen was labelled *E. violaceum*, suggesting that his earlier report of *E. violaceum* obtaining "a considerable footing" in the Bathurst district (Peacock, 1904) referred to *E. vulgare*. Cunningham's 1910 specimen from



Fig. 3.—Distribution of *E. vulgare* in Australia (based on collection localities of herbarium specimens).

Tumbarumba and Brett's 1914 specimen from Bathurst were labelled *E. plantagineum* and the 1916 collections by Brett and Rutledge included one specimen labelled *E. plantagineum* and one labelled *E. vulgare*. These collections suggest that *E. vulgare* was quite common on the central and southern tablelands by the early 1900s. The plant was proclaimed as a noxious weed in December 1912 (Maiden, 1916). It probably did not occur around Albury in 1916, despite Maiden's (1916) rather confused report that "*E. vulgare* or *plantagineum*" was spreading in this area. Certainly, *E. plantagineum* is now abundant and *E. vulgare* does not occur in the Albury district, despite reports by Moore (1967) and Macoboy (1972) to the contrary (see p. 228). At present, *E. vulgare* is quite common on roadsides and, to a lesser extent, in pastures around the tablelands (Department of Agriculture of New South Wales Report, 1961; Willis, 1972), especially in the coastal and mountain regions near Sydney (Beadle *et al.*, 1962, 1972) and in the Australian Capital Territory (Burbidge & Gray, 1970).

In South Australia, *E. vulgare* was first collected at Georgetown (1893), and this specimen is now lodged in the Melbourne Herbarium. The oldest specimen at the Adelaide herbaria is from Clare (Dec. 1943). As discussed earlier (pp. 233-4), reports around the 1900s of the occurrence and spread of *E. vulgare* in South Australia probably all refer to *E. plantagineum*. *E. vulgare* now grows sporadically only around Clare and Mount Gambier (Eichler, 1965).

The earliest collections of *E. vulgare* in Tasmania were from North Esk in 1881 and Port Arthur in 1892 (a rather indistinct fragment). It was later recorded at Cambridge (Feb. 1912) and Hobart (Jan. 1916), and was probably quite common at this time because it was proclaimed as a noxious weed in 1912. By 1955, it was scattered in the north-east and the Tamar Valley (Raphael, 1955) and is now an occasional plant in dry waste places (Curtis, 1967).

CONTRAST BETWEEN AUSTRALIA AND OVERSEAS

From information presented in this study and in Piggin (1976), it seems that the occurrence and abundance of the three *Echium* species considered here differs in their native regions from regions where they have become naturalized. In countries around the Mediterranean and Atlantic coasts of Europe and northern Africa, where they seem to be native, they are all common but rarely abundant on roadsides and in waste areas and pastures.

In countries where they are introduced the situation seems to be different. In southern Australia *E. plantagineum* is the most widespread species and is frequently abundant, *E. vulgare* is common but much less widespread and *E. italicum* is quite rare. A similar situation seems to exist with *E. plantagineum* and

E. vulgare in other places such as South Africa, north-west United States of America and southern South America which, like southern Australia, have Mediterranean-type climates. In contrast, in cooler places such as the British Isles, northern Europe, Russia, Canada and central and western U.S.A., *E. vulgare* is the most widespread and common species, although rarely is it as abundant as *E. plantagineum* in Australia, whilst *E. italicum* and *E. plantagineum* are less common. These contrasts are probably due to differences between regions or countries in the number and nature of early plant introductions, the suitability of climate, the extensiveness of agriculture, the human population density, and the occurrence of phytophagous organisms that attack each species (see Doing, 1966; Moore, 1967). Certainly, in Australia, *E. plantagineum* seems to be the species that was most commonly introduced as a garden plant around the 1850s, it is well suited ecologically to grow in the annual pasture areas of southern Australia (Piggin, 1976), and it is heavily attacked and damaged in Europe by a range of insects that do not occur in Australia (Wapshere, 1975).

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A NEW SPECIES OF LASTREOPSIS (ASPIDIACEAE) FROM NORTH-EAST QUEENSLAND

by

DAVID L. JONES*

SYNOPSIS

Lastreopsis grayi is described as a new species from the rainforests of the Atherton Tableland in north-eastern Queensland. Its closest congener is another as yet undescribed *Lastreopsis*.

INTRODUCTION

Tindale (1957, 1961a, 1961b, 1965) has revised the genus *Lastreopsis* and discussed in detail the species which occur in Australia.

In August 1971 the author collected *Lastreopsis* species in the Tinaroo Hills on the Atherton Tableland of north-eastern Queensland. Among the specimens were several of a slender undescribed species with deeply dissected fronds and a solitary specimen of a similar but coarser species. Further specimens of both species were located in subsequent trips into the area during May 1972 and November 1974. The slender species will be described by Tindale in a forthcoming issue of *Telopea*. The coarser species is here described as new.

***Lastreopsis grayi* D. L. Jones, sp. nov.**

Rhizoma erectum, 1.0–2.5 cm crassum, paleis sparse praeditum (plantis vetustioribus rhizomates secundaria axillares generantibus); *paleae* 1.0–2.5 mm longae, plerumque anguste lanceolatae badiaequae, ad marginem et basin rotundatam versus pallidiores, earum marginibus fimbriis expansis irregularibus sparse praeditis, apice obtuso vel attenuato; *stipites* 10–40 cm longi, circiter 3 mm lati, erecti, virides vel viridi-brunnei, nitidi, ad basin flexuosi, pilis parvis appressis sparse ornati (praesertim in canaliculo), ad basin paleis sparsis similibus illis in rhizomati; *rhachides* patenter alatae, virides vel viridi-brunneae, leves, in canaliculo a pilis parvis ornatae; *lamina* anguste triangularis, 15–40 cm longa, 10–35 cm lata, tripinnatifide vel quadripinnate dissecta, pallide vel saturate viridis, glabra, nitens; *pinnae primariae* infimae maximaeque 8–16 cm longae, 3–10 cm latae, ad rhachidem primam oblique inclinantes, basiscopice dilatatae, apice attenuato dentato-serratoque; *pinnae secundariae* ad rhachidem secundariam obliquae, illis basalibus anguste alatis, illis superioribus late alatis adnatisque, apice attenuato dentato-serratoque; *segmenta ultima* pedicellis alatis praedita, alternantia, oblonga, aliquando falcata, non congesta, apice obtuso, subter glabra vel a glandibus flavis ornata; *venae* in superficie submersae et non prominentes, infra clariores liberae simplices vel unifurcatae; *costae et costulae* glabrae vel a pilis parvis atque glandibus flavis sparse vestitae; *venulae* similes; *sori* exindusiati, orbiculares, 0.5–1.0 mm lati, marginales (in parte interiore loborum), ad apicem venularum gesti, juveniliter albi, mature ferruginei vel fusco-brunnei; sporangia 90–140 per sorum, eorum annulo c.12–15 cellulas induratas et 6–10 cellulas tenues comprehendenti, pedicello c.5-cellulari pilum stipitatum oblongum aurantiacum glandulosumque gerenti; *sporangia* bilaterales, globoso-ellipsoideales, fulvae.

* Horticultural Research Institute, Knoxfield, Victoria

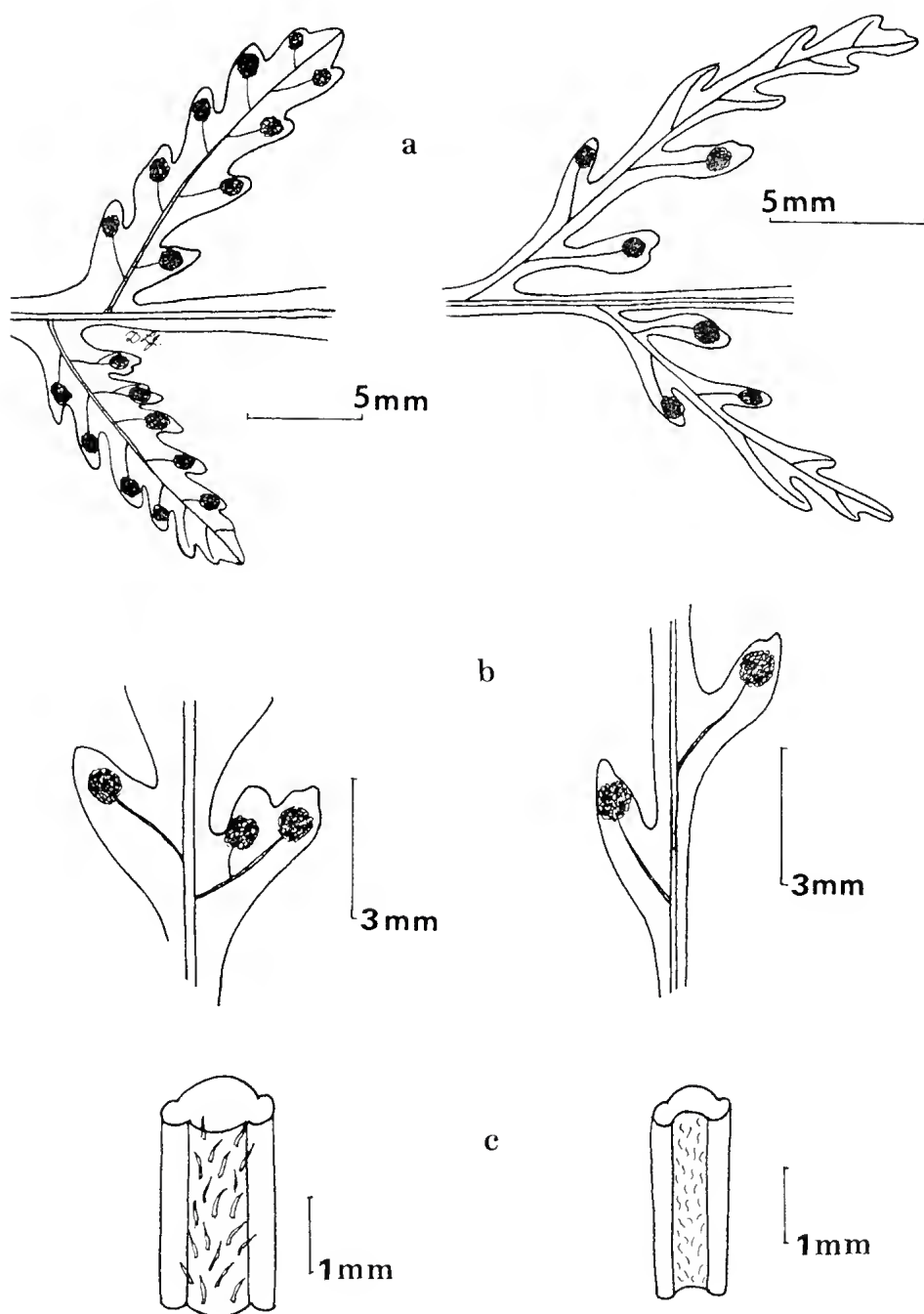
HOLOTYPE: Queensland, Cook District; rainforest along small creek in Lamb Range (Tinaroo Hills), 2 kilometres south-west of Mt. Haig, Atherton Tableland, at about 1000 m altitude. (17°06'S; 145°34'E.), D. L. Jones, B. Gray & R. Collins, xi. 1974 (BRI).

ISOTYPES: BRI, NSW, MEL.

Rhizome erect, 1–2.5 cm broad, in older plants producing secondary axillary rhizomes and becoming multi-crowned, sparsely clothed with scales; scales 1–2.5 mm long, some ovate and pale but most dark brown, narrow-lanceolate, paler towards the rounded base and the margin, the margins sparsely clothed with irregular spreading fimbriae, the apex obtuse or drawn out; *stipes* 10–40 cm long and about 3 mm wide, erect, green or greenish-brown, shiny, flexuose at the base, clothed sparsely with small appressed hairs especially in the groove, the scales of the base sparse and similar to those on the rhizome; *minor rhachises* conspicuously winged, green or greenish-brown, smooth, clothed with small hairs in the channel; *lamina* narrow triangular in outline, 15–40 cm long x 10–35 cm wide, 3-pinnatifid or 4-pinnate, anadromous, dissected and lacy, pale or dark green, shiny, glabrous; *lowest primary pinnae* the largest, 8–16 cm long and 3–10 cm wide, obliquely set to the main rhachis, basis-copically enlarged, the apex attenuated and dentate/serrate; *secondary pinnae* oblique to the secondary rhachis, the basal ones narrowly winged, the upper ones broadly winged and adnate, the apex attenuate and dentate/serrate; *ultimate segments* with winged pedicels, alternate, oblong, occasionally falcate, not crowded, the apex obtuse, undersurface glabrous or with small yellow glands; *veins* on the upper surface submerged and not prominent, those on the lower surface more prominent, free, simple or once forked; *costae* and *costules* glabrous or sparsely clothed with small hairs and yellow glands; *veinlets* similar; *sori* 0.5–1 mm in diameter, exindusiate, rounded, borne at the apex of veinlets, marginal, on the inner side of lobes, white when young, rusty brown or dark brown when mature; *sporangia* 90–140 per sorus; annulus composed of about 12 to 15 indurated cells and 6–10 thin walled cells; pedicel of about 5 cells, often bearing a stalked oblong, orange glandular hair; *spores* bilateral, monolete, globose-ellipsoid, yellow-brown; *perispore* crested, with balloon-like wings.

DISTRIBUTION AND ECOLOGY

Lastreopsis grayi is only known from scattered localities in the Tinaroo Hills of north-eastern Queensland. It always occurs in dense rainforest, usually along small creeks and gullies, growing both in the soil and leaf litter of the rainforest floor as well as on rocks. Plants are often solitary or in small scattered colonies.



Lastreopsis grayi

***Lastreopsis* sp.**

Fig. 1.—a—Part of secondary rhachis and ultimate segments; b—Lobes of ultimate segments with sori; c—Section of rhachis.

DISCUSSION

Lastreopsis grayi is a rare species, the closest congener of which is another undescribed *Lastreopsis*. This latter species is more common and widespread than *L. grayi*, usually grows in fairly large colonies and is easily recognised by the very fine, lacy, deeply dissected fronds. The differences between the two are shown in Table 1 and some comparisons are made in the accompanying figure. Both species are readily distinguished from other native *Lastreopsis* with erect tufted rhizomes by the finely dissected, lacy fronds, the blunt segments lacking spines, and the exindusiate sori.

<i>Lastreopsis</i> sp.	<i>Lastreopsis grayi</i>
stipes shallowly grooved, the hairs about 0.1 mm long	stipes deeply grooved or ridged, the hairs about 0.3–0.5 mm long
secondary rhachises inconspicuously winged	secondary rhachises conspicuously winged
ultimate segments deeply lobed, the lobes long and widely spaced	ultimate segments shallowly lobed, the lobes short and closely spaced
sori one per lobe, each sorus of up to 50 sporangia	sori 1–4 per lobe, each sorus of up to 140 sporangia

Table 1.—Contrasting characters.

The rarity of *L. grayi* prompted speculation that the species was a hybrid. A thorough study of two colonies during November 1974 showed nothing to support this hypothesis. Significantly, there were no species in the localities with the characters necessary to create the progeny. The only other *Lastreopsis* nearby were *L. rufescens* (Bl.) Ching and *L. wurunuran* (Domin) Tindale, both villous, coarse-leaved species. It was interesting to note that there were many sporelings of *L. grayi* present in one colony and these were readily recognisable as the species. Sporelings have been raised by the author and have come true to type.

The epithet *grayi* is a tribute to Mr. Bruce Gray of Atherton. He is a very observant collector with a unique knowledge of north Queensland flora, and has many interesting botanical discoveries to his credit.

ACKNOWLEDGEMENTS

The author wishes to express thanks to Mr. B. Gray for hospitality, specimens and information, Mr. S. B. Andrews, Botanist, Queensland Herbarium, for encouragement and criticism of the manuscript and Dr. J. H. Willis for preparation of the Latin description.

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A NEW COMBINATION IN PULTENAEA JUNIPERINA Labill. (PAPILIONACEAE)

by

MARGARET G. CORRICK*

Pultenaea juniperina Labill. in Nov. Holl. Plant. Specim. **1**:102, t.130 (1806) var. ***mucronata*** (Benth) M. G. Corrick, comb. nov.

Pultenaea flexilis Sm. in Ann. Bot. **1**:502 (1805) var. *mucronata* Benth in Fl. austr. **2**:135 (1864).

Pultenaea juniperina Labill. var. *planifolia* H.B. Williamson in Proc. Roy. Soc. Vict. new ser. **33**:138 (1921).

The holotype of *Pultenaea flexilis* var. *mucronata* Benth. is a "Clarence river, Beckler" collection, of which material is held at the Royal Botanic Gardens, Kew (K—photograph seen) and National Herbarium of Victoria (MEL 515976). *P. juniperina* var. *planifolia* Williamson is based partly on the same Clarence River collection and the name is therefore illegitimate and must be rejected (Article 63, International Code of Botanical Nomenclature). Williamson's placement of the variety under *P. juniperina* rather than under *P. flexilis* is botanically correct and the new combination of *P. juniperina* var. *mucronata* is therefore necessary.

ACKNOWLEDGEMENT

I wish to thank Miss Helen Aston of the National Herbarium of Victoria for assistance and advice.

* National Herbarium of Victoria

**PLACYNTHIUM (Ach.) S. F. Gray, A GENUS OF LICHENS
PREVIOUSLY UNREPORTED FROM AUSTRALIA**

by

WILLIAM A. WEBER*

During my tenure of a fellowship from the Australian National University, 1967-1968, I had the opportunity of collecting lichens intensively in New South Wales. From these collections I report the following two species of *Placynthium* (Ach.) S. F. Gray, a genus for which there are no previous records from Australia (Weber & Wetmore 1972).

Placynthium nigrum (Huds.) S. Gray. New South Wales—5 miles east of Cooma on road to Numeralla, on limestone outcrop above the stream, Weber & McVean L-49054, 2.x.1967 (COLO); head of Neringla Creek, 3 miles NE of The Big Hole near Krawaree, east of the Shoalhaven River, on limestone in wet sclerophyll forest, 2500 ft alt., Weber & McVean L-49723, 19.iii.1968 (COLO). This species is characterized by having squamulose lobes and usually a prominent, bluish-black prothallus. A common and widely distributed species in Europe and North America.

Placynthium subradiatum (Nyl.) Arn. New South Wales—Bungonia Lookdown, on rimrock above Shoalhaven River Gorge, on massive limestone boulders, Weber & McVean L-48907, 10.iv.1968 (COLO, CANB, MEL). This species has a thallus with radiating, contiguous marginal lobes; characteristically the interior portions of the thallus flake off in age leaving arcs of tissue formed by the leading edges. A species widely distributed in Europe and North America (Henssen 1963).

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